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MUNICIPAL ENGINEERING

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COST KEEPING ON MUNICIPAL CONTRACT WORK.

By De Witt V. Moore, Moore-Mansfield Company, Indianapolis, Ind.

MUCH has been written, especially in later years, on the subject of cost keeping on contract work. The subject is an intensely interesting one to the engineer and the contractor. The engineer needs reliable information in order that he may make intelligent estimates that will be adequate and which will enable the work contemplated to proceed without delay occasioned by the receipt of bids in excess of such estimates. There is also a high degree of personal satisfaction to the engineer to receive bids which place the stamp of approval upon his preliminary estimate. To the contractor such cost information is part of his stock in trade, and it is just as essential as to know the cost of materials and the rate of wages.

Cost data, however, are only valuable when all the circumstances and conditions surrounding the work are thoroughly familiar to the party using same. For this reason the cost data collected by any contractor are of far more value to him than to others. Much of the cost information published in the engineering magazines, periodicals, and books is misleading. The fault does not lie in the honesty of purpose of the one furnishing such information, but is more often due to the lack of mention of conditions attendant upon the work. The writer in his own experience has many times had occasion to compare jobs which apparently, by casual observation, seemed to be very closely similar, but when the proper analysis is made, the jobs have been found to be radically different.

There is another cause for looking with distrust upon much of the published cost information, due to the fact that the results are determined merely upon a basis of observation for a limited period of time. No information obtained in this manner can be relied upon. If an observation is made of a job at a time when the weather is good and the work is moving along nicely, and it is determined that a gang costing $100 per day is able to accomplish 100 units of work and the cost therefore is established at $1.00 per unit, the cost information secured is erroneous. We may assume that the day following the weather is bad and the gang is laid off. When this is done, there is always a certain fixed pay roll which cannot be so cut off and continues through the period of no work; for instance, the foreman, timekeeper, night watchman and possibly an engineer or fireman. If such pay roll should continue on the work at a cost of $10 for the day following the record mentioned above, the cost of the work for the two days of observation will be $110, or $1.10 per unit.

The kind of work to be done, the time of year, etc., are all elements which enter into the cost of the work and the unit of cost of the individual items of work can only be determined when conducted over a length of time sufficient to add to the actual cost of each item of work, the average percentage due to loss of time, padded pay roll, etc.

As these are items which are very often overlooked or not mentioned in the published reports of cost, the engineer or contractor should be very careful in his use of the information. It is for this reason that the statement was made previously that there is no information as valuable as a man's own experience, for in a case of this kind, the moment figures are referred to for a certain job, at once there is present a mental picture of the work and the conditions, circumstances, and methods of doing the work. The mental picture, however, is not of any particular value

unless during the progress of the work the attempt has been made to secure just as reliable cost information as is possible regarding each and every item of the work.

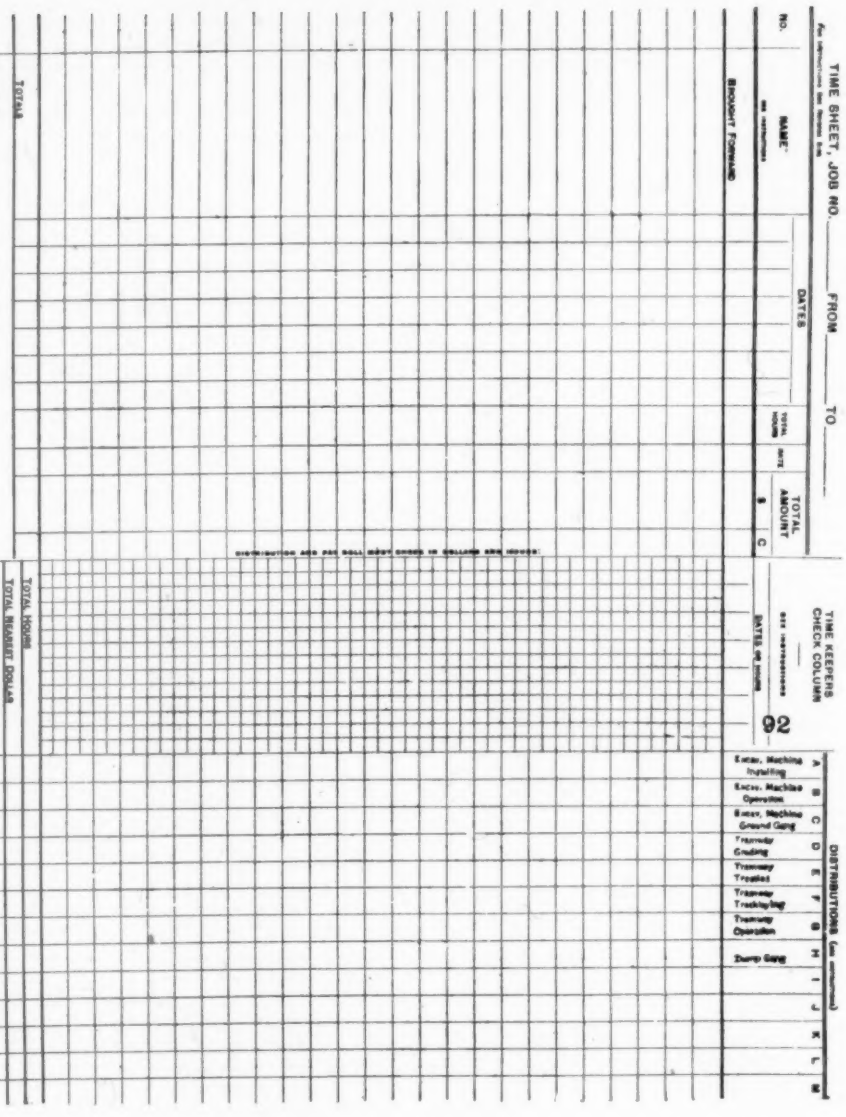
There is no class of work upon which the cost information can be secured any more readily than in municipal contracting. The contracts for sewers, streets, sidewalks, etc., are generally of considerable size upon which the cost is more or less uniform. The work being very largely uniform, it is very easy to settle upon units of work which are repeated daily. The opportunity thus offers not only of arriving at the unit cost, but the percentage of the efficiency of foremen and men can be readily determined. The writer has had several years experience and has given a great deal of thought to the subject of collection of cost data, and to him it is one of the most interesting studies he has ever been engaged upon. It is not altogether with the idea of securing cost information which may be used upon future work, although the information is valuable for this purpose, but because of the much more intelligent supervision which may be given to the work as it proceeds that causes this subject to be so interesting and so valuable.

The methods of cost keeping vary with different men and probably to some extent this is necessary and desirable, since by so doing each man gets the information in the shape most valuable and most satisfying to his own mind. However, suggestions are always in order and sometimes prove of value, and it is for this reason that the writer presumes to offer to the readers of MUNICIPAL ENGINEERING the method now being used by him in his own work.

The first essential in the proper securing of cost information is to include in the organization for any job an intelligent, energetic time-keeper. He should be more than a timekeeper, in the sense of being of a clerical frame of mind, and if possible should have some experience in construction work. The time sheet used by the writer is shown in Figs. 1 and 2. Fig. 1 shows the face of the time sheet, whereupon appears the statement of the time of the men in as simple form as possible, and similar to the ordinary time book. On the opposite side of the page, however, the opportunity is given to check up the kind of work each man was engaged upon, and such time is distributed to the proper account. On the reverse side, Fig. 2, the opportunity is given for the reporting of the information incident to the work and also a summary report and detailed instructions for the use of the time sheet. In order to make any statement or time sheet of any particular value, it should be so arranged as to be more or less flexible in order to take care of different kinds of work. This has been accomplished in this particular form by the use of a special form of printed time sheet to be adopted for use on any particular job by the printing in of headings with a rubber stamp. In the illustrations given the rubber stamp headings are for the construction of a boulevard and the meaning and use of same will be evident to the reader. The time sheets are so arranged that they may be used for either daily or weekly reporting of the work, depending upon the size of the job and the importance of a close distribution. The timekeeper in making weekly report, carries the time for the week and uses the timekeeper's check column on the opposite side for a check on the men four times a day, using the proper letter for the particular distribution in each of the four little crosses forming the record of a man's work under the particular date. Where closer distribution is demanded and the time sheets are used daily, the man's time for the day previous is put in the total hour column and the amount earned in the total pay roll. The time is then checked in the timekeeper's check column on the basis of one-half hour intervals, taking each vertical division as one hour. The first column is taken at 6 a. m., the next 7 a. m., and so on through the day. If a man changes his occupation on the even hour the check mark is made in the upper square, and if on the one-half hour interval in the lower square. By an arrangement of this kind the time is checked automatically; for if a man is checked in at 7 a. m. on any one particular distribution as shown by the letter and does not change for the entire day no further check marks are required. If, however, he should change at every hour in the day a check mark is made at that time and the timekeeper can count up directly the hours spent on each class of work from the time sheet. The reports being of uniform size and character on all jobs makes them very convenient for filing and for reference.

Once each week the timekeeper, by himself or in conjunction with the superintendent and engineering representative in charge of the work, fills out the summary work done on the right-hand side of the back of the time sheet

1. TIME SHEET MOORE-MANSFIELD CO. FIRST PAGE, SHOWING METHOD OF KEEPING TIME ON DETAILS.

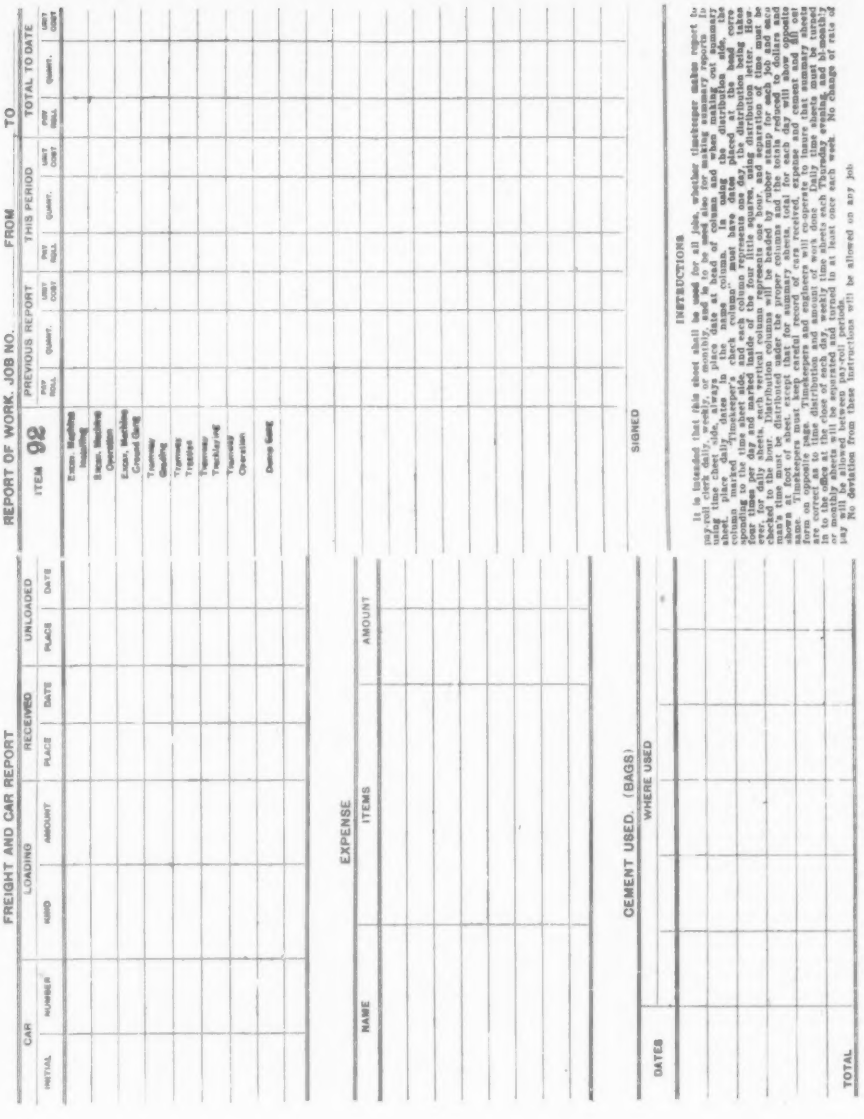


I. TIME SHEET MOORE-MANSFIELD CO. FIRST PAGE, SHOWING METHOD OF KEEPING TIME ON DETAILS.

showing the work done for the period and the total work done to date. The rubber stamp used here gives the same unit items on the reverse side for distribution and the information is at once available as to the cost of the work in its comparison with the work done previously. The time report goes first to the pay-roll clerk, who makes up his pay rolls directly from the time sheets and the time sheet then goes to the cost record clerk, who posts the cost record in the cost record book. This latter, however, would not be necessary were it not for the fact of condensing the information, as the time sheets preserve for any job the same information.

The form of time sheet mentioned has been used by the writer for a considerable time and has been found to work very satisfactorily on all kinds of construction work.

Particular emphasis, as given by the writer, is then upon the method of cost keeping rather than upon the information secured, and for this reason no particular cost figures will be given.



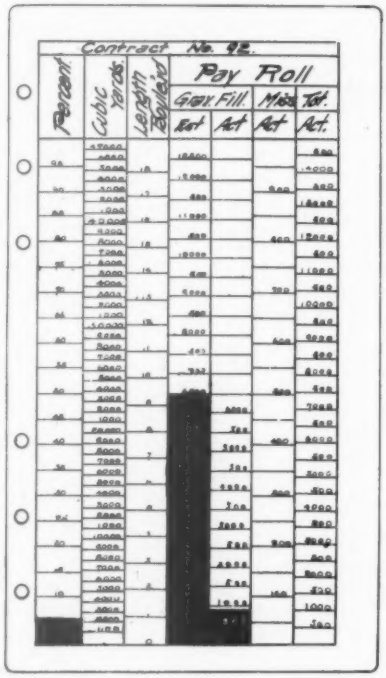
II. TIME SHEET MOORE-MANSFIELD CO. REVERSE SIDE, SHOWING DISTRIBUTION TOTALS.

If the unit of cost is kept in the manner suggested, the superintendent is enabled to give the closest attention to that part of the work which is running behind, and the attention is at once directed to such items, thus avoiding all uncertainty of knowing just where the leaks are on a job which is showing up badly.

Progress sheets should always be kept on the job upon which the amount of work accomplished may be colored in every day. As such progress sheets will vary with the kind of work, no attempt is made to give a standard form of such time sheets, except that they shall be of such size as to be filed readily with the time reports.

Further and final benefit to be secured from cost keeping is to summarize any cost work as to the condition, rate of progress and percentage of completion of any job. The time sheets suggested, of course, show to a certain extent the information just mentioned, but a better method is to provide a summary sheet similar to the one shown by Fig. 3. Upon this sheet

are posted the results as reported from time to time by the time sheet, using the reverse side report of work done. By slight modifications a report of this kind can be made of any job. This benefit lies in the fact that the amount of work accomplished and the cost when colored in the proper columns at



III. PROGRESS SHEET, SHOWING STATUS OF WORK AND EXPENSE.

once give the relative progress of the work in dollars and also percentage of work completed and give a basis upon which an intelligent idea may be had of the time of completion of the work and whether or not the job will make or lose money. Referring to Fig. 3, the information as to the amount of work done can be obtained either by the cubic yards placed or by the length of boulevard completed, then the corresponding percentage of the work completed can be ascertained. If but one method of determining the work is given, the other is also read off the chart. In the figure 100 per cent. in the percentage column is equivalent to about 48,000 cubic yards, which is equivalent to about 1,950 feet in length. The estimated amount of labor spent upon making the gravel fill is shown as being $6,500, which amount is shown opposite the 50 per cent. line in the per centage column. As making the gravel fill in this particular case is the most important item, it is the only one shown in detail, the other labor costs being shown under a miscellaneous column and no estimated figure shown. The scale in the actual cost column is so arranged as to provide for the total cost of the work.

Referring again the the figure, suppose that at some period during the construction, 20,000 cubic yards of fill are reported as having been made. We at once see that this is equivalent to the length of 800 feet of completed boulevard and equivalent to about 42½ per cent. of the amount of work to be done. Dividing this per cent. by two, or 21¼ per cent., and reading across to the estimated pay roll for this much gravel fill, we see that we should not have spent, if we are keeping within our estimate, more than about $2,700, and for the work complete any more than $3,250. Supposing that our reports show that we have spent to this same period $3,500 for gravel fill, we at once read from the report that we are 42½ per cent. completed, but that we have expended for gravel fill 55 per cent. of the estimated cost and that, unless conditions improve, the job is going to be a bad one, and that we will exceed our estimate by like amount. Within a reasonable certainty, knowing the time that it has taken us to accomplish the 42 per cent. of work, we can anticipate the time it will take us to complete the 100 per cent., and there is an additional satisfaction of being able to make an intelligent prediction.

BUILDING A REINFORCED CONCRETE PIPE SEWER.*

By Alexander J. Taylor, Engineer in Charge of Sewers, Wilmington, Del.

IN deciding upon the character and the material from which the sewer described should be built, terra cotta pipe, monolithic concrete and brick were each rejected in turn from considerations of economy and ease of construction, and a decision was made in favor of reinforced concrete pipe with curves of brick where angles occur.

*From a paper before the American Society of Municipal Improvements.

The points adverse to the use of such a pipe were considered and disposed of as follows: The character of the sewage for quite a considerable portion of the course is acidulous, in consequence of which there were fears of a softening or solvent action upon the concrete composing the pipe. As an experiment a portion of a condemned pipe was immersed in representative sewage and allowed to remain for ten months without showing any alteration. A further safeguard to the lower portion of the sewer consists in its receiving the lime water from a paper mill in quantity probably sufficient to neutralize the acid, while the latter in turn may be expected to prevent any lime incrustations.

The reinforced concrete pipes were made by the regular sewer workmen in immediate proximity to where they were to be laid, the mixing boards being moved every morning before starting. Probably everyone is familiar with their construction, but an outline of the work may not be amiss. The concrete being mixed in the proportion of one part Portland cement, three parts sand and stone dust combined, and four parts three-quarter inch stone, resulted in forming a mass possessing compactness as well as strength. The pipe being exposed on all sides after completion ample opportunities were presented to judge of this. The sections are three feet in length, varying in thickness from three and one-half inches for the thirty-inch to four inches for the thirty-six-inch pipe, and are reinforced with two circumferential bands, one-eighth inch by one-and-one-half inch, placed one foot apart and one foot from each end. These are slotted to allow five longitudinal bars to be threaded through them. These longitudinal bars extend beyond the shoulders of the pipe and are hooked at the ends to provide for interlocking the various sections, after the latter are placed in position, by means of an additional circumferential band slipped through the hooks. Steel forms with an outer and inner ring were used, each being in three separate pieces and joined together when set up on the cast-iron bed plate. The pipe was cast in a vertical position with the bell end down. The bottom ring is first placed in position, levelled and greased, the wall forms previously oiled are next slipped into position and latched, sliding on grooves in the bottom ring. The longitudinal reinforcing bars are then set in position, their lower hooked ends entering into depressions made in the lower rings to receive them. At the upper end these bars are caught and held in position by clamps, which serve in addition to keep the wall forms the proper distance apart. A stiffening band is slipped inside and hung upon the upper end of the inner cylinder to prevent distortion. When the molds are set up and braced, each is an exact duplicate of the others, so the finished sections must fit when joined. The concrete must be carefully tamped in layers not exceeding two or three inches in depth or the unconsolidated portions will show on the completed work. When one foot of concrete has been deposited and rammed the clamps on the longitudinal bars are removed temporarily, a circumferential band slipped over them, the clamps replaced and concreting resumed. After another foot in height is completed a similar operation takes place. When the upper end of the pipe is reached a cast-iron collar having a section that will hold a spigot end is placed in position, filled with concrete, smoothed with a small trowel and the pipe is finished. The forms were stripped the following day, but the sections were allowed to set on the iron base plate for five days before being turned over, being kept damp by repeated sprayings during this period. They were allowed to stand and cure for at least two weeks before being handled to any extent or placed in the trench. This latter was accomplished by means of a movable wooden tripod from which was suspended a triplex chain hoist of one ton capacity, the heavier pipe weighing approximately fifteen hundred pounds per length. The laying of the pipe can be readily and rapidly done, the whole secret, if there be one, consists in having the bottom of the trench carefully prepared to the proper depth in advance and in having each pipe laid accurately to line and grade so that the succeeding sections may fit perfectly, any inaccuracy in this regard making itself perceptible for several lengths. When placed in position the tie bands are slipped through the hooked ends of the longitudinal bars, locking the various pipes together, then a band of galvanized iron is fitted snugly around the outside of the pipe and the joint grouted, the bands being pulled out as soon as the cement has set.

Conditions at the outlet render it essential when repair work is in progress in the race, to temporarily by-pass the sewage through an open ditch around the head gates and into the creek below the dam. For this purpose a baffle gate, set in a concrete chamber three feet by three feet in section was

constructed from the ordinary two by twelve inch hemlock lumber around the work. It is eight feet long by three feet high and when closed lies flush against the sidewall, closing the by-pass opening; when opened it is swung across the chamber at an angle of thirty degrees with the side, opening the by-pass and closing the straight run. This gate is swung from three twelve-inch strap hinges and held up to a clearance of one-eighth of an inch from the bottom, being supported at the outer end by a trolley wheel running on a curved one-eighth by one and one-half inch bar iron set on edge in the concrete.

Above this point for several hundred feet the difficulties were chiefly a question of location, for it lay wholly in a piece of woodland under the care of the park commission, in consequence of which considerable manoeuvering was necessary to get a suitable line and avoid tree cutting; however, at last, everything worked smoothly.

In the succeeding section was encountered the first real difficulty of the work. The line ran through the slope of an embankment of made ground, with settling ponds ten feet deep on one side and the creek on the other. The slope made one side of the ditch several feet below the other, so that the tripod could not be used in the regular way. On the lower side there was built a platform, supported by six by six inch struts to the level of the upper bank, and upon this the tripod leg was slid as work progressed, a strip being nailed on the platform to prevent the kicking out of the leg and the upsetting of the whole apparatus.

When the work had progressed as fas as the creek wall of the paper mill, the center line being located within three feet of the wall rendered the abandonment of the tripod necessary, due to lack of sufficient room in which to spread the legs. Here there was an A-frame of six by six inch timber with the upper end resting against the mill, the chain hoist hanging from a cross timber between the legs, sufficiently far down from the apex of the frame so as to be over the center line of the pipe. This proved to be a very clumsy device to move and it was planned to put wheels on the two legs and also at the top where the frame rested against the wall. For various reasons this was delayed and was never done, and all the pipe in this section was laid with the simple A-frame, excepting that portion which crosses the tail race of the mill.

Here the conditions forced the design within such narrow limits as not to allow of any other solution except that of carrying the sewer in the air over the race, a span of sixty feet. Further limitations prevented the use of an arch, however flat, and necessitated some steel construction. Very fortunately the mill owners allowed the building of three small piers in the race, thereby quartering the span, but in the calculations these were disregarded entirely, as there exists a probability, however remote, of their being swept out by the ice during some spring freshet. Some small protection is afforded them by extending the abutment walls of the race a small distance toward the creek. The final design consisted of two twenty-four-inch I-beams, with six inch by three-eighth inch bands, eighteen inches center to center, bent so as to fit over and riveted to the upper flange of the beams and with the lower portion rounded to the half section of the outside of the pipe. Every three feet of their length the I-beams are fastened together by two and one-half inch by two and one-half inch by three-eighth inch angles riveted to their top flanges.

While it is expected that the joints will be tight and the pipe non-porous, an additional safeguard was provided in the bending to the shape of the pipe of sheets of No. 12 gauge black iron 48x72 inches in size and placing the same directly upon the iron bands, and then fitting the pipe closely into the bent sheets. All the steel work was painted a uniform color.

The piers, although small, presented some constructive difficulties which were annoying. The water was about five feet deep with quite a strong current flowing, while there was not sufficient space in which to build watertight coffer dams. The box molds were built of 2x8-inch tongued and grooved N. C. pine pieces with their lower edges bevelled and driven hard on the rock bottom in an effort to make a tight joint and to exclude as much water as possible, without any success in that line. Under these conditions good concrete work was secured by the men standing in the water within the forms, taking the concrete in buckets, diving under the surface, and emptying the buckets on the bottom or on the material already deposited, so as to prevent the separations of the mixture into its component parts. Sufficient ramming was secured by the tramping around of the men. This was carried on in successive layers until the water

surface was reached, above which the concrete was deposited from barrows in the usual way and rammed.

The steel work was placed easily by employing rollers on each pier. In laying the pipe at this point both the tripod and the A-frame had to be discarded, for the only available footing was the top flanges of the two 24-inch I-beams spaced four feet center to center. In their stead were employed two cross frames fifteen feet apart supporting an 8x8-inch horizontal hoisting timber from which hung the chain block. The frames were identical in design and consisted on each side of an upright 6x8-inch timber braced by two inclined strips of the same size, their lower ends being nailed to pieces of 2x6-inch securely bolted to the I-beams, the upper ends of the posts being fastened together and braced by a cap of 6x8-inch timber upon which the hoisting timber rested.

The only other point of interest lies in the general outline of the inverted siphon, which deviated somewhat from the usual design, its profile bearing a striking resemblance to the edge of a saw. The regular grade of the 30-inch pipe was stopped about one hundred feet back from the up-stream bank, where a vertical drop of ten and one-half feet was provided into a grit chamber, fifteen feet in length, divided into two compartments. From this a double line of 30-inch pipe leads on an up-grade of 2 per cent. for 85 feet to the edge of the water, ending in a manhole with a single 30-inch outlet. It is expected that any sediment contained in the sewage, which would deposit in the pipe, will do so at this section on account of the lessened velocity due to the up-grade and the additional area from the double pipe. This can be readily cleaned by closing one pipe and is easy of access both at times of high and low water. From here the profile was governed by topographical conditions and the character of the excavation and consists of a down-grade of 4 per cent. for 250 feet under the creek bottom and a final leg on an up-grade of 6 per cent. This last being of the larger size of 36-inch pipe. Considerations of economy dictated this course, a saving being effected in pipe on account of not running a double line for the whole distance; a saving in excavation, for it is in solid granite; but mainly a saving in time, advantage being taken of a short dry season to do the work, which if prolonged to a time of high water would have necessitated an expensive coffer dam.

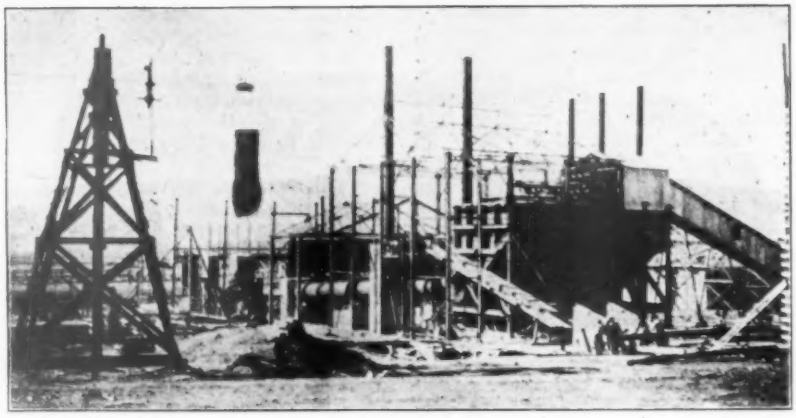
THE LOS ANGELES CEMENT PLANT.

By Edgar Percival, Los Angeles, Cal.

THE cement plant in process of construction at Aqueduct, near Tehachapi, Cal., for the city of Los Angeles, in connection with the water supply scheme, is the first ever erected by a municipality, and it has also the record of being the second plant erected for the purpose of completing a special work. The city cement work officials expect to use on the aqueduct 1,000,000 barrels of cement, at an estimated cost of $1.05 per barrel, as compared with the lowest price submitted by the Colton company of $2.75, laid down at Aqueduct.

These works are well located on the Southern Pacific Railway line, and are being built in a substantial manner, and equipped with the best quality of material and latest improved plant, for a 1,200 barrel capacity. There is ample accommodation to duplicate this output by the addition of three more kilns and the necessary mills. There are immense deposits of limestone and clay available for the purpose at Aqueduct. The city owns 3,500 acres of land, including three limestone deposits and one clay bed, the latter covering 300 acres. Exploration borings find clay over the whole extent of the area, and it has been proved uniform in composition to a depth of 32 feet, while the same condition has been found to exist in several places, where artesian wells were bored, to a depth of fifty feet. These works will undoubtedly prove a fine commercial asset to some private company, when the city has completed the work for which they are being established.

In January, 1903, the site of the municipal cement factory was bare of any improvements, and there was no house nearer than a mile, that was available for housing any mechanics. A farmhouse was rented and about fifteen carpenters and laborers commenced work on February 1, 1908, building bunk houses and a mess hall

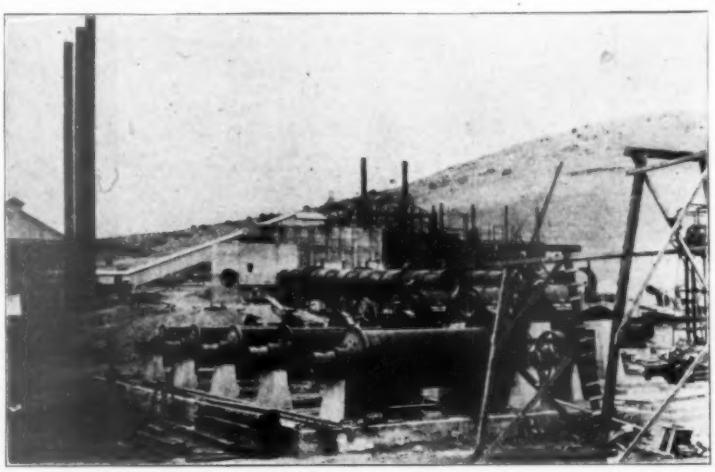


LOS ANGELES CEMENT PLANT.
View from Raw Material End of Plant Under Construction.

at the new mill town site located five miles east of Tehachapi on the Southern Pacific R. R. Grading teams commenced grading for yard trackage, and at the same time to provide facilities for unloading machinery.

Early in March bunk houses, office buildings and railroad sidings were completed and the numbers in the construction gang were increased. Active construction work on foundations was initiated and machinery began to arrive and be installed.

The city owns three limestone properties. The Cuddeback Ledge is in a 160-acre trac, distant three miles west of the mill. The North Quarry is in a 640-acre tract five and one-half miles northwest of the mill. The South Quarry is in a 120-acre tract located six miles southwest of the mill. During the past year prospect work has been done on all three deposits. demonstrating that the last mentioned deposit is the largest and most uniform, and is the highest grade limestone. This deposit has been adopted for supplying limestone for the mill. A quarry is being opened on the side of a hill, eight hundred feet above its base. An aerial tramway is installed with a carrying capacity of thirty tons per hour and forty-seven hundred feet long. It will deliver limestone to a bin near the base of the hill having a capacity of 250 tons.



LOS ANGELES CEMENT PLANT.
View from Finishing Mill End of Plant Under Construction.

A narrow-gauge surface railroad is completed from this bin to the cement mill five and a quarter miles distant. Cars and a locomotive have been purchased for equipping the railroad which will deliver rock directly to a crusher at the cement mill.

A cableway 5,800 feet long with a capacity of twenty-five tons per hour is now in operation transporting the clay already excavated from the clay bed to the cement mill. In the rear of the mill a storage floor for a six months supply of clay has been provided and is now filled.

Cars deliver the limestone to a No. 6 crusher, belt driven by motor. The crushed rock is conveyed on belt conveyor to a three-hundred-ton storage bin in the dryer building. This bin discharges on to an apron conveyor, which delivers by connecting elevator to a rotary dryer five feet in diameter by fifty feet in length. From the dryer the rock is elevated and stored in steel bins above a battery of Krupp ball mills, comprising six mills. A mill consists of a drum having a diameter of about double its length, filled with steel balls. The drum revolves on a horizontal axis, at a speed of from twenty-one to twenty-seven revolutions per minute. The lining of the drum is made up of overlapping steel plates, which form steps. As the drum revolves the balls drop over the steps, pounding the material to pieces. This mill, with the balls it contains, is very heavy, and takes almost double normal torque for starting. These mills grind the rock to pass a twenty-mesh screen, and deliver it by screw conveyor and connecting elevator to a bin above a mixing machine. The ball mills are operated by individual 50 h. p. motors, belted to the mills. The mills are equipped with dust-proof clutch pulleys.

In a pit beneath the clay storage floor, previously referred to, is a clay disintegrator, motor driven. Clay passes into this machine, either directly from the aerial tramway buckets by an automatic discharging arrangement, or from the storage pile on the floor above.

The disintegrator discharges on to a belt conveyor, which deliver the clay to a rotary dryer. This is a duplicate of the rock dryer and is placed alongside the latter. The dryer delivers the dried clay to an elevator that spouts it into a bin above a rock emery mill. This 42-inch emery mill grinds the clay, and it is then elevated and spouted into a bin above the proportioning machine.

At this point is located a proportioning machine, which can be regulated to mix the ground limestone and clay in the required proportions, which are approximately, three parts of limestone to one of clay by weight. The proportioning is done here by volume, however.

This machine delivers the materials into a puddle mixer below, thence the mixture is passed by elevator and screw conveyor to steel hoppers above a battery of Krupp tube mills. These mills are each six feet in diameter by sixteen feet in length, driven by individual 75 h. p. motors by belts. There are nine of these mills, filled with flint pebbles, and they can take the output from the ball mills, either raw material or clinker, and grind it to the desired fineness for burning or for finished cement, 95 per cent. of the output passing No. 100 mesh. The mills are equipped with dust-proof clutch pulleys.

The tube mills deliver the raw mixture to a screw conveyor, connecting by elevator with another screw conveyor placed above storage bins behind the kilns. The raw mixture is delivered by screw conveyors, water-jacketed, and provided with changeable speeders, into the kilns. There are three rotary kilns, each 125 feet long by seven and one-half feet in diameter, equipped with variable speed devices. The kilns are operated by individual belt-connected 25 h. p. motors.

The kilns discharge clinker into three rotary coolers, placed on a lower floor and driven from a line shaft by clutch pulleys. These coolers are of a larger diameter than commonly used, and are designed to largely disintegrate the clinker before it is discharged into a continuous pivoted bucket conveyor.

This conveyor elevates and conveys the clinker on its upper strand above a storage floor, where it is piled for ageing. When ready for grinding the clinker is delivered through spouts in the ceiling of a tunnel beneath the storage floor, into the buckets of the lower strand of the conveyor, for conveyance to the finishing department. An elevator at the end of the pivoted bucket conveyor passes the clinker to a screw conveyor for distribution to bins above a battery of ball mills. After passing through the ball mills the clinker goes to a proportioning machine, where the retarding plaster is added; then to a battery of tube mills. After final grinding in these tube mills, the cement is conveyed by belt and screw conveyor to the stock-house bins.

The gyratory type of crusher used is that which is used in almost all cement mills employing the dry process, and consists essentially of a vertical spindle, on the upper end of which is mounted a chilled iron crushing head that moves inside a hopper-shaped top, into which the rock is fed. The bottom of the spindle passes loosely through an eccentric, driven from a horizontal shaft by bevel gears. The spindle, therefore, has a gyratory motion.

As the head, running eccentrically, approaches and recedes from the sides of the hopper, the stone is gradually crushed, and falls down between the crushing surfaces. The stone is broken by hand to a convenient size to feed into the hopper.

An improved feature of the plant is the economizer, installed for the purpose of using the stock gases from kilns to heat the boiler feed water for power plant. By this installation it is expected to reduce cost of power by 12 per cent.

The proportioning machine is unique, inasmuch as it proportions the limestone and clay in the raw mixture accurately and continuously, requiring scarcely any attention. The chemist can adjust the proportioning device and lock it so that it remains as desired until altered.

The power plant has also some unique features. There are four water tube boilers, having a total of 1,500 boiler h. p. These are connected to two steam turbines, each of 500 k. w. capacity, and of special construction calculated to carry 50 per cent. overload continuously.

Streets in the city's new town of Aqueduct have been surveyed, sewer and domestic water systems have been installed and fifteen frame buildings have been erected by the city for the housing of employes. A general merchandise store is operated by a private company. A hospital building is in charge of a steward and is equipped for emergency cases. An abundant supply of excellent artesian water was secured at a depth of 120 feet. This water is pumped up to a 100,000 gallon concreted reservoir, located on a terrace above the town and mill sites. This insures adequate pressure for fire protection. Water is piped to the houses, and the two largest dormitories are provided with shower baths.

The demand for houses at low rent has been urgent, and will increase greatly when the plant is put into operation.

The mill is practically ready to start. An eastern structural steel firm contracted to complete the buildings by November 15, but they have been seriously behind time, and the completion of the plant and its operation has waited on the building contractors.

The aerial tramway from quarry to the terminal of the narrow gauge road, and the narrow gauge road itself, are about ready. The cable way from the clay bed to mills is in operation. The steam electric power plant is complete and ready for operation. The concrete fuel oil reservoir, with storage capacity for a month's operation of the plant, is finished. The stock house, with capacity for storing 30,000 barrels of cement, is now completed. The crushing, drying, grinding and burning machinery has been installed and is ready to operate as soon as the installation of conveyors, elevators, shafting and motors can be completed, but this could not be done until the building was erected.

The mill is equipped with a complete machine repair shop, fitted with lathes, shapers, radial drills, power saws, pipe and bolt cutters and threaders, and all the necessary equipment.

On completion, this will be one of the best equipped cement factories in operation.

METHOD OF INVESTIGATION OF CHARACTER OF WATER SUPPLY OF MICHIGAN CITY, IND.

MR. H. E. Barnard, chief chemist, and J. H. Brewster, water chemist, of the Indiana State Board of Health, have made an interesting report upon the character of the water drawn from Lake Michigan by Michigan City, Ind., for distribution to its citizens, which contains much valuable information. The investigation upon which the report is based was undertaken because of the continued high death rate from typhoid fever in the city, averaging 45 and ranging from 0 to 112 per 100,000 during the past 26 years. This rate has gradually increased from an average of 35 in the

6 years 1882 to 1887, to one of 57 in the 5 years 1903 to 1907. A continued rate above 20 is an indication that something is at fault with the water supply. The rate at Michigan City has fallen below 20 but 2 years in the last 20. The city's epidemics of typhoid fever occur in the winter, between January and May, an additional indication that the water supply is at fault.

A temporary bacteriological laboratory was established at the life-saving station, equipped for making colony counts and the presumptive test for bacillus coli. Sampling points were located and marked by buoys in the area within a 2-mile radius from the harbor mouth, the only near source of pollution; also in the navigable part of the harbor and Trail Creek. Daily samples were taken from July 15 to August 5 from the mouths of Rummel ditch and the Fourth street sewer and the harbor intake, the present water works intake and the intake for the prison water supply, at a depth of 10 feet below the surface; also observations of direction and velocity of wind and direction of lake currents. Bacterial analyses of about 400 water samples and chemical analyses of about 75 samples were made.

The movement of water in Lake Michigan is dependent upon local winds, slightly affected by atmospheric temperatures and the flow from the larger streams. This has been proved by observations made under direction of U. S. engineers. Counter currents are clearly shown, winds blowing toward the shore bringing surface water in and shore water washing out, while off-shore currents take surface water out and the deep water flows toward shore. The general lake currents seldom get within 5 miles of shore, so that the currents at the Michigan City intake are the local shore currents, and may be quite different from the general lake currents, owing to differences in winds and the effects of the government pier and breakwater. Currents in the harbor are very slight, as shown by the fact that a float on the river will often stay for days within a length of four city blocks, going back and forth. Floods in the streams cause currents of 5 or 6 miles an hour to run out into the lake for days, carrying fresh and accumulated sewage matter, while at other times there may be currents of 4 or 5 miles an hour into the harbor. The average of these opposing conditions is estimated to be an outward movement at a rate of about one mile in four hours. Lake levels vary during light winds a very few inches, and during severe storms nearly a foot. These fluctuations and their causes deserve close study because they affect the flow of sewage-polluted water into the lake.

During the period of observations in July and August, 1908, the prevailing wind was northerly, raising the lake level and retaining the sewage in the harbor until the solids settled out and the pathogenic germs died, so that changes in wind brought partially purified and diluted sewage out into the lake and produced less effect than at other times upon the water at the city intake. The long continued dry weather also operated to reduce the amount of sewage discharged into the harbor. The lake had the highest July stage it has had since 1888.

The lake water naturally is generally clear and colorless with little organic matter and comparatively low bacterial count. It is low in sulphates and chlorides and relatively high in carbonates. The increasing volume of sewage is slowly but surely raising the chlorine, sulphate and nitrate content. Along the Indiana shore wind and currents sometimes stir up deposits of clay on the bottom and make the water more or less turbid. The water in its normal state approaches absolute purity and is then unquestionable. Water intakes are close in shore and when near sewer outlets require examination to determine the amount and character of pollution.

Michigan City is built on sand and the lake bottom is mostly sand, with a few areas of clay, sloping gradually to a depth of about 55 feet 2½ miles from shore. The harbor is dredged out of the channel of Trail Creek and has some two miles of docks with factories, lumber and coal yards and channel for vessels drawing 15 feet, which is about 208 feet wide. Piers extend into the lake for a half mile on each side of the outlet of the harbor, with a breakwater beyond, running perpendicular with the piers, with harbor entrances at both ends. The bottom of the harbor is heavy clay, covered with ooze, settled from the sewage, which is in some places 10 feet deep.

The city's water supply comes from an intake 3,700 feet from the mouth of the harbor in lake water 40 feet deep, unless the intake becomes clogged with ice, when harbor water is used. The end of the supply main is turned up to prevent the sand running in. A new intake is under construction 600 feet beyond the present intake, and is in 50 feet of water, where there will be less trouble from needle ice. This in-

take will be in a wooden rip-rapped crib.

When the present intake is clogged with ice the harbor water is pumped back through it to clear it out and is also pumped into the city mains, sometimes for as long as 15 hours. Epidemics of typhoid fever and euteric disturbances seem to follow these uses of the harbor water, which is shown by analyses to be grossly polluted. The works being on a direct pressure system, there is no reservoir or standpipe to tide over the anchor ice troubles.

The prison water works plant is independent of the city and its intake is 3,800 feet from shore in 30 feet of water, and is 5,800 feet west of the mouth of the harbor.

The present Michigan City supply is polluted

1. By the sewage of the city. This is from a population of 21,000, including the prison, discharging into the harbor in two places, 10,500 gallons a minute in all. Rummel ditch receives part of this sewage and carries it to Trail Creek. Having little water of its own, this ditch is a serious nuisance and source of disease much of the year. The sewage flows in and out of the harbor as above described.

2. By shore wash and stirring up of the bottom by wave action, producing excessive turbidity at times, although the deposits on the bottom are usually old enough to have become innocuous.

3. By dumping the dredged material from the harbor too near the intake, so that these deposits, which are more recent and more objectionable, reach the intake at times. This dumping should not be permitted within 3 miles of the shore.

4. By droppings from boats, which pass near or even over the intake with large loads of passengers, sometimes as often as twice an hour, presenting a constant menace of contagion which can not be removed except by federal legislation and supervision.

5. By disturbances of sand suckers, removing sand of certain grades within a few hundred feet of the intake. These machines should do their work far enough away so that the suspended matter they stir up will not reach the intake.

The water supply is in part protected by several factors against the pollution the lake receives.

1. The natural dilution of the small amount of sewage by the great volume of water, which is ample except for the influence of currents caused by the wind and the piers and breakwater.

2. The natural death of the pathogenic organisms in the purer water of the lake, although they may exist for several weeks under favorable conditions.

3. Sedimentation when the water is quiet, the surface water, passing off first, being thus materially improved in condition. The stirring up of the water and the sediment by wave action in storms or by floods in the creek may cause a concentration of pollution for a time, during which the condition of the water would be very bad.

4. Sunlight sterilizes the water very rapidly at the surface, and the vertical currents cause this effect to be distributed throughout the water.

The wells in Michigan City, many of them, show heavy pollution by sewage and are not suitable for drinking and domestic purposes. A few in the lightly populated sections furnish good water. Probably about half the wells in the city should be closed and many others will require closing in the near future.

Chemical analyses of water in July from the harbor at the harbor intake and from the water pipes at a date in January when harbor water was pumped into them for a short time, under the circumstances above detailed, show the serious pollution of the harbor water. Analyses of samples taken from the mouth of the harbor, the east end of the breakwater and one mile out showed that very little harbor water was entering the lake, for reasons above detailed. These show that under the July conditions the harbor is a sedimentation basin, which materially changes the character of the water. These conditions will not exist during flood time in Trail Creek, when the accumulated sediment will be flushed out into the lake.

Bacteriological analyses were made at numerous points within and without the harbor during 19 days in July. The samples from the lake showed no material differences. Those at the mouth of the harbor fluctuated somewhat with the flow of the harbor current. The character of the harbor water showed decided differences, indicating that the changes in currents modified the effect of the sewage, so that the amount of pollution could be predicted approximately if the direction and rate of the currents were known, or the currents could be defined if the analyses of samples were compared. The bacteriological and chemical analyses were alike in showing that the harbor water did not reach the lake during the time of the tests.

The changes of currents with the wind about the harbor entrances caused observed differences in bacterial counts on account of the varying amounts of sewage-polluted harbor water reaching the points of observation. There being no strong west winds and currents during the period of observation, points east of the harbor showed low bacterial counts. All lake points, including all three intakes, showed absolutely safe and wholesome water at all times during the test, no sewage getting outside the breakwater.

There was no rain during the period. One of the sewer discharges was reduced to zero by sedimentation, absorption and evaporation in Rummel ditch, and the other was reduced in flow, so that the total sewage discharge was less than half the normal. The prevailing strong north winds kept the sewage in the harbor.

While the results do not show the unfavorable conditions possible locally, they show that this section of the lake is not yet affected by the pollution from Chicago and throughout the Calumet region, which is making an enormous pool of diluted sewage unfit for drinking five miles from shore along the Chicago front.

With conditions as at present Michigan City's water supply is safe and should be so preserved.

The recommendations include the removal of the harbor intake of the water works so that it can not possibly be used; that the water at the intakes in the lake be studied under unfavorable conditions of flood and winds; that all shallow wells be abandoned; and that the present sewer system be so extended and improved that all household and domestic sewage is rendered innocuous by suitable treatment before it enters the harbor and lake.

THE BALTIMORE SEWERAGE SYSTEM.

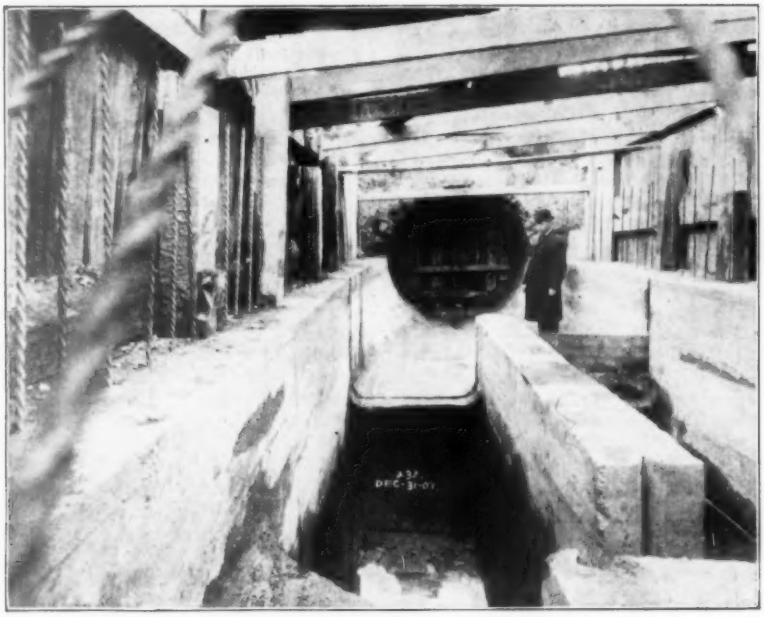
By Littell McClung, Baltimore, Md.

THE city of Baltimore has in hand an undertaking unique in the history of great municipalities—the construction of an entirely new sewerage system that will be the most modern in the world. As the work develops it becomes one of the finest and most elaborate pieces of modern engineering. The drainage systems of other large centers of population have been built, enlarged and improved steadily, commensurate with the growth and needs of the respective cities. But for years Baltimore has strangely neglected her drainage, which for the most part has been surface drainage. While she has been putting her electric light, telephone and telegraph wires underground, she has failed to provide any sewerage system whatever. This neglect has been due in a measure to the natural drainage advantages that the Monumental City enjoys. Situated at the head of the Patapsco River, which is not a river but an arm of the Chesapeake Bay, the city rises gradually, stretching back in a great semi-circle. The whole city, with its northern, western and eastern suburbs, inclines toward the Patapsco River and the Chesapeake Bay. Hence all the drainage flows easily into these waters.

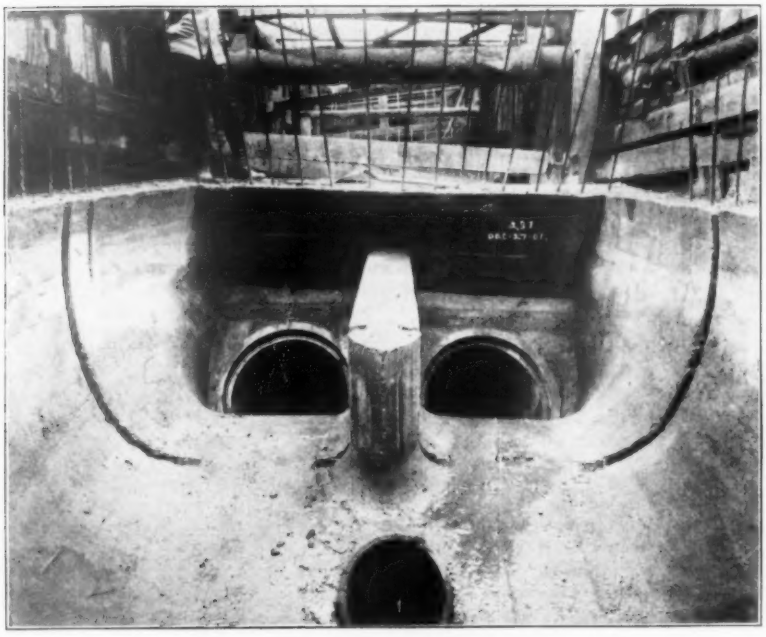
But after the great fire of February 7 and 8, 1904, which destroyed seventy blocks in the business heart of the city, the citizens voted for several large loans to make municipal improvements. These included the increasing of wharf facilities along Light street, where most of the passenger steamer traffic is handled; the building of a comprehensive system of docks along the north side of the harbor; the erection of modern markets and new engine houses; the construction of a more elaborate system of subways for wires and pipes; the building of a tremendous reservoir several miles north of the city, and, greatest of all, the laying of a new system of sewers.

The construction of this sewerage system will take seven years and will cost $18,500,000. It was thought at first that it would require about fifteen years to build the sewers, but the engineers have made such unusual progress that less than half this time is now set as the limit of completion. Mr. Calvin W. Hendrick, formerly of New York, is chief engineer and is in charge of the work, which is beginning to attract the attention of engineers in Europe as well as in this country.

As a matter of fact, the undertaking is fraught with more difficult details than the cutting of the Panama Canal.



BALTIMORE SEWERAGE SYSTEM.
Reinforced Concrete Sewer Junction.



BALTIMORE SEWERAGE SYSTEM.
Entrance to Inverted Syphon Under Railroad Tracks.

At first blush this statement might be questioned. The work in Panama extends over a forty-mile route, a part of which is covered by a river and a lake made by dams. The main cost is in two herculean items—cutting through the backbone of the isthmus between the Atlantic and the Pacific, and the construction of a gigantic dam. This means large masonry construction and the removal of great quantities of earth, which run the cost into vast sums.

The work in Baltimore extends over 1,100 miles, for there will be more than 1,100 miles of sewers and drains, every foot of which has to be dealt with separately to overcome innumerable underground obstructions. The engineers have encountered wires and pipes of every description, and have found far down in the earth wooden sewers more than a hundred years old. Nearly two thousand men are employed on the work with locomotives, teams, cableways, derricks, steam rollers, trench machines, steam shovels, hoisting engines, diggers and scrapers, and concrete mixers. At no time must the excavation interfere with the city's water supply or the telephone, telegraph, or electric light or gas service. In some places the engineers have had to face most baffling problems. Two tunnels have to be cut and two streams to be crossed. One of the greatest difficulties lies in the fact that a large area of the city, that adjacent to the harbor, is considerably lower than the final place of deposit of the sewage, presenting a great hydraulic problem. Indeed, so extensive is the system that it naturally divides itself into four great problems, the laying of sanitary sewers in a densely populated city, the installation of storm water drains in a section that is subject to frequent overflow, the hydraulic phase of the work, and the building of a disposal plant.

BALTIMORE SEWERAGE SYSTEM.

The Twelve-Foot Outlet Sewer.

Two separate systems are being constructed—the storm water drains and the sanitary sewers. The former, of course, will carry off all rain water and melting snow, and its pipes will empty into the harbor. The sanitary sewers, which will make connection with every house in the city from the skyscraper down to the cottage of the factory worker, will not empty into the harbor nor the Patapsco River nor the Chesapeake Bay.

The sanitary system is divided into three parts, the high level division, the low level division, and the outfall sewer. Covering the largest part of the city, the first will be a magnificent

system of pipe lines, while the low level division will cover all that part of the city which is near sea level.

The outfall sewer, already 80 per cent completed, will carry the drainage from the double sanitary system to the filter beds on Back River, more than six miles east of the city. This sewer is practically a tunnel under the eastern section of the city, being 12 feet in diameter. The sewage from the low-lying section will be lifted nearly 70 feet into the outfall by three pumps, the like of which have never before been constructed.

These pumps are now being built by the Bethlehem Steel Company. Each will pump 27,500,000 gallons every twenty-four hours against a head of 70 feet, the capacity of all three being 82,500,000 gallons a day. Space will be left for the installation of two more pumps of like capacity. Two of the pumps will lift the sewage from the low-level section for years to come, the third being kept in reserve for emergencies. Each pump will weigh 1,200,000 pounds and will have chambers 7 feet in diameter. They will be driven by 600-horsepower engines of the vertical triple-expansion crank and flywheel condensing type, each having three cylinders, 22, 41, and 62 inches in diameter.

The building that will house these herculean pumps and engines will be of stone and steel, 188 feet long by 175 feet wide and 110 feet high. Its foundations will be carried to a depth of 23 feet below mean tide, or about 31 feet below the surface. The boiler room will be 50 by 94 feet and the engine room 180 by 54 feet. Above the boilers there will be coal bins of 1,200 tons capacity. As the building will stand on Jones Falls, a stream that runs through the city, it will have rail and water transportation for getting in coal and removing ashes.

Before passing the pumps the sewage will go through two great screens. Then the pumps will send it up 70 feet through cast-iron force mains to the 12-foot outfall sewer. Ultimately there will be four force mains, but only two will be cast at present.

Flowing by gravity through the outfall sewer for six miles, the drainage will run down to the Back River section of the far eastern suburbs into a disposal plant, passing through various processes of treatment by gravity such as that of hydrolitic tanks and digesting tanks, thence being sprinkled over stone beds more than 8 feet deep, passing by underdrains into settling basins and thence into Back River, about fourteen miles from where this river empties into the Chesapeake Bay. The drainage, when finally discharged into the river, will be as near pure as the river water.

Striking progress is being made in carrying out this titanic undertaking. Though it will not be finished until 1914, it will be adequate for Baltimore for at least a third of a century to come.

CEDAR RAPIDS UNDER THE COMMISSION PLAN.*

By Chas. D. Huston, Councilman, Cedar Rapids, Iowa.

IOWA, we believe, is the only State in the Union to follow the lead of the Lone Star State in adopting the commission plan of government, and Des Moines was the first city in Iowa to adopt the plan. The act was made applicable to all cities of Iowa having a population of over 25,000 which desired to adopt the plan, and because of this fact Cedar Rapids is the second city in the State to adopt the plan. The date of adoption was December 2, 1907, and the first election of officers took place March 30, 1908, and consequently our city has had six months of commission government. The plan was adopted by only thirty-three majority, the small majority being due, as I believe, to the fact that Cedar Rapids' affairs had been generally creditably administered. In the fifty-two years that have elapsed since our city secured its charter I have no doubt that a great majority of the mayors and councilmen elected labored earnestly and honestly for the city's good.

The commission plan, among other things, provides for the election of a mayor and four aldermen, all nominated under the primary system and elected by the entire vote of the city. Other officials are appointed by council, except such as come under civil

*From a paper before the League of American Municipalities.

service rules, among whom are included police and firemen.

The business of the city is divided into five departments as follows:

Department of Public Affairs, in charge of the mayor.

Department of Accounts and Finances.

Department of Public Safety.

Department of Streets and Public Improvements.

Department of Parks and Public Property.

An alderman has charge of each one of the above named departments. The mayor and aldermen devote their entire time to the business of the city. The mayor has no right of veto, but a vote on every question.

No franchise for interurban, street railways, gas, water works, electric light and power plants, heating plants, telephone or telegraph lines can be granted except by vote of a majority of the electors at a special or general election.

Any ordinance may be presented to the council upon a petition of 25 per cent of the vote of last preceding municipal election, when the council must pass said ordinance unchanged within twenty days, or submit same to special election; or if said ordinance contains only 10 per cent of the voters, then the council must pass said ordinance within twenty days or submit at next municipal election.

No ordinance, except for immediate preservation of the peace, health or public safety, shall go into effect before ten days from date of passage, and if during that time a petition signed by 25 per cent of the voters cast at preceding municipal election be presented to the council protesting its passage, said ordinance shall stand suspended, and if not repealed shall be submitted for approval of the voters at a special or general election.

After six years of the commission plan any city may return to the old system on the vote of the people.

There are many beneficial features under the commission form of government, but I shall take time to consider only a few.

Direct Nominations by Primary. Nominations made by the people at the polls and in the open. Those who have taken part in the manipulations of caucuses or observed the manner in which caucuses have been handled for selfish ends, the good intentions of many citizens often being thwarted by a cleverly designed motion which took out of the hands of the people the selecting of delegates and placed it in the hands of those who named delegates to vote for candidates inimical to their best interests, will not be slow to recognize the privilege secured to them of expressing their preferences personally at the primary.

Equal Opportunity to All. Many men capable of rendering good service to a municipality, under the caucus system would never be able to get their names before the people, owing to the manipulations of so-called ward bosses, who have delegated to themselves from year to year the privilege of making a "slate" and seeing that it is carried out. Under the commission plan any one can secure a petition and have his name appear on the ballot and be voted at the primary, and every citizen has an equal opportunity before the voters. To show how popular this part of the plan is, we have only to mention that fifty-seven citizens took advantage of it in Cedar Rapids last March, nine for mayor and forty-eight for councilman, although but five could hope for election and but ten could qualify. Under this provision the people have been given two opportunities to approve or disapprove an aspirant for civic position—once at the primaries and once at the general election. The man who thus passes inspection may be considered well worthy to entrust with the responsibilities of government.

Alphabetical Ballot. The names of all candidates appear in alphabetical order without party designations. This wholly eliminates party prejudice and voters cast their ballots for those whom they believe will render the best service.

Eliminates Ward Lines and Gives Majority Rule. Under the commission plan no one can be elected either mayor or councilman unless he secures a majority of all votes cast, thus there can be no doubt of his being the choice of the electorate. This is a great improvement over the old ward system, under which vicious and undesirable citizens are frequently elected, and while they may have been fairly representative of their constituents, their power for evil in a council is not to be under estimated.

Concentration of Authority and Responsibility. How different under the new than under the old plan of committees of three, often with as many different ideas of procedure, and often opposition to any proposed improvement unless it is made in their particular ward or its equivalent promised before consent is given, and a needed work long delayed, if made at all, no

matter how urgent. Under the commission plan there is no delay. If a certain improveemnt is needed, it is recommended by the head of the department under which it properly belongs, it is made regardless of what section of the city it is in. It becomes a matter wholly of merit and no commissioner will take the responsibility of recommending an expenditure on even one piece of work the wisdom of which may be questioned, and thus subject himself to discipline by being shifted to some other department and another being placed in charge to conserve the best interests of the public. As a commissioner in charge of a particular department, he must and does take the responsibility of that department. The excuses made by derelict aldermen under the old plan that the other members of the committees overrode him, cannot be offered.

The Initiative and Referendum. The application of this principle places upon the people themselves the responsibility of government—where it rightfully belongs. In providing the referendum, the commission plan of government trusts the people to pass upon great questions of local concern, by taking the power to grant special privileges out of the hands of the council and vesting it in those who are the rightful owners, and who are and should be entitled to say whether they shall or shall not be granted. This means the elimination of corporate influences in the selection of councilmen, because councilmen will no longer be able to deliver the "goods" bargained for. It leaves the people free to dispose of their own as they see fit, instead of as under the old plan delegating the authority to a few who may be unscrupulous enough to use it for the furtherance of selfish ambition.

The Recall. This provides that a derelict mayor or councilman may be recalled at any time for cause. Like any other principal, they may dismiss an unsatisfactory agent.

I can hardly expect that critical persons will be fully satisfied that I have made out a clear and good case for the commission plan unless I include the financial and practical features.

The city's revenues (not including special assessments) are approximately $325,000 per annum. From January 1 to April 6, 1908, three months and six days, under the old plan, there was paid out of these revenues the sum of $119,639.12, which does not include $5,000 expended by the park commissioners during the same period, or almost $40,000 per month, which might be termed operating expenses only, being in a season of the year when no improvements were being made and when no bonds or interest fell due. A continuance of expenditures at this rate for twelve months would have exceeded the revenues about $100,000.

Under the commission plan in five months (lacking six days) there was expended a little less than $152,000 or less than $31,000 per month, and this included payment of $49,600 in bonds and interest, all park expenditures and $2,500 purchase money for additional property. Nor was this all, as the police department was augmented by the addition of five patrolmen, the fire department stables were replenished, city buildings were put in repair and painted, many street lights added, the heaviest work of the year in street cleaning being on and an unusual amount of street improvements being made, and yet the expenses were about $9,000 less per month than had been running and no betterments being made.

On September 1 there was a cash balance in the city treasurer's hands of $113,078.92, which, with the revenues yet to be collected, will permit of the closing of the fiscal year with a handsome balance, should no unforeseen crises decree otherwise.

Cedar Rapids has no unpaid bills, the council at the outset making a ruling that all bills except those for labor should be discounted 2 per cent. in ten days, and the city has rigidly adhered to the rule, paying all bills promptly, and you really would be surprised to know what those discounts amount to monthly. Interest amounting to about $2,000 per annum will be collected on city funds during the last nine months of the year, and in three months alone the interest amounted to $1,000 on an even $100,000 for which a time certificate was taken. Heretofore the interest turned in amounted at best to about $400 per annum. The city of Cedar Rapids has under construction at the present time the largest amount of brick paving, macadam road building, storm and sanitary sewers and water pipe extensions in her history, and soon will let a contract for the construction of a second concrete bridge over the Cedar River which will cost approximately $75,000, and other bridges of less importance, and there will be no increase in taxes to pay the bills, it being simply a matter of careful financiering and getting a dollar's worth for a dollar expended, which is always the test of civic government.

In this connection it may not be out of place to state that with the inauguration of the commission plan of government in Cedar Rapids, the responsibilities of the department of streets and public improvements have been almost doubled by reason of the several new additions, which have been thrown open to the public this year, additions not of the usual type, but provided with all the conveniences of modern life, water, sewers, gas, light, macadamized driveways, permanent sidewalks, etc., and which have been expensive to the city in the matter of engineering and inspection service.

I contend that the commission plan is practical from every view point. In the first place, it provides for a reasonable compensation, if not large, $2,500 to mayor and $1,800 per annum to each councilman, and requires services therefor.

Whether the people of Cedar Rapids selected the five best men that it was possible to select as their first commissioners might be questioned, but no one will question the patriotism and unselfish devotion to public service on the part of four of them (not including myself), for, in the language of the street, they are always to be found "on the job" and their own private interests, no matter how large or how important, are not even a secondary consideration.

Mayor Carmody is proprietor of a large foundry and machine works; Councilman Miles is a lawyer and real estate dealer, head of department of finance; Councilman Sherman is newspaper proprietor and publisher, and head of the department of public safety; Councilman Keffer, formerly city clerk, has no business entanglements. He is the head of the department of parks and public property, and the writer has charge of the department of streets and public improvements and is the proprietor of a printing establishment.

We make no claim that the commissioners of Cedar Rapids are any more able, better qualified or more patriotic than any other five men that might be selected under the same plan in this or any other city. They are just ordinary citizens who are not afraid to roll up their sleeves and give unsparingly of their brains and brawn to build a city upon a solid foundation and beautify it a little, too, as they go along, and they are just unselfish enough to give all the time necessary even though it may take twenty-four hours of the day.

At first the commissioners were somewhat hampered, because of being a special charter city, which made necessary the revision of ordinances to conform to the general law, this is being done as occasion requires or permits, and affairs are being conducted most pleasantly, there being harmony among the commissioners, harmony in every department of service, and discord no where. City affairs indeed, under this plan, are being managed much as a corporation is managed, the mayor being the general manager, and the councilmen acting in the capacity of directors. They recognize that what the people want is results, and that the responsibility lies with the council to get results. There is no opportunity to dodge. It was an alderman's business to dodge under the old plan, but a commissioner never. He has duties to perform and he knows and the people know whether or not he is fulfilling them, as there is a monthly record published of his every act. Should he prove incompetent or derelict he can be changed from one department to another, and if not satisfactory in that department, the recall may be invoked, and if this is not considered advisable, there is an election as at no distant day when he can and will be dropped.

In the selection of appointive officers none were chosen because of their political affiliations, indeed, men were chosen because of the belief in the minds of the members of the commission that they possessed those qualifications necessary to render good service; because of their especial fitness for the work in the departments to which they were assigned; because of their high conception of the duties that would devolve upon them because of their possessing high ideals. In many instances men were chosen who were not applicants at all, and some were induced to take public service only when they were convinced that it was a duty which they owed to the public to give some service to the city in which they had their habitation, and which guaranteed to them and theirs all the advantages and privileges that any city could guarantee. And further, not one appointment was made for the purpose of paying a political debt.

The commission plan is more popular with each passing day. It has awakened more civic spirit in Cedar Rapids than was ever before known. The plan is giving us a new Cedar Rapids. Men and women consult the members on a hundred things, seemingly trivial as a single proposition,

yet important in the civic development as a whole, and which in the days of the old plan would not be considered worthy of attention and investigation. These matters, both great and small, receive prompt attention—so prompt, indeed, that men of years of experience under the old plan are really dazed by the suddenness of action at times.

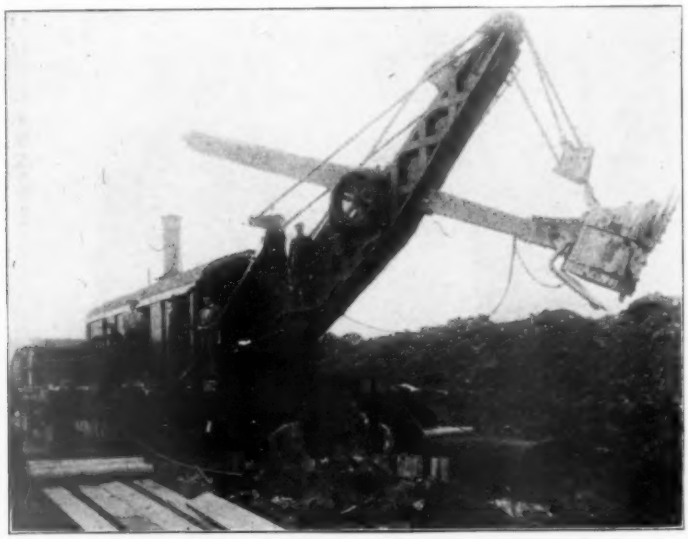
The best evidence we have of the acknowledged success of the plan in our home city, is that those who were opponents are becoming its warmest advocates. And the man who would go back to the old plan of government must be irreconcilable.

In our opinion there be no question as to the wisdom of adopting the commission plan of government, whether the city be great or small; that not one argument can be put forth in favor of the old plan to ten that can be advanced in favor of the new, and that a faithful observance of the principles laid down in the commission plan for the conduct of city affairs will make a clean, progressive, up-to-date city of the most unkept and illy-governed in state or nation.

CONCRETE SEWER CONSTRUCTION IN CHICAGO.

By Frank C. Perkins, Buffalo, N. Y.

THE accompanying illustrations show the equipment and method of construction of a 5-foot concrete sewer near the southwest limits of Chicago, this being a link in an extensive sewerage system, including 9,000 lineal feet of concrete sewer under construction being 5 feet in diameter. The concrete for this sewer is mixed approximately 1:3:5, varying somewhat as the gravels run fine or course.



CONCRETE SEWER CONSTRUCTION.
Digging Trench with Dipper Dredge on Platform.

fourteen miles of main sewers with 9-foot outfall into the Chicago Drainage Canal. There are also nine miles of laterals from 1 to 1½ feet in diameter.

This concrete sewer varies from 4½ feet to 5½ feet, the largest part of the

The accompanying illustration, Fig. 1, shows the 65-ton shovel with 1¼-yard dipper used for the excavation. Fig. 2 shows the placing of the piling and braces and cleaning up after the shovel, ready for placing the concrete

CONCRETE SEWER CONSTRUCTION.
Trench Bracing and Bottom.

CONCRETE SEWER CONSTRUCTION.
Completed Monolithic Sewer and Form for Arch.

in position. Fig. 3 shows the completed sewer, with form in place in the foreground for extension of the sewer arch.

It will be noted in Fig. 1, that the shovel has been removed from its truck and mounted on a heavy timber frame. This frame is 30 feet wide and the shovel is moved ahead by its own power by means of a block and tackle on rollers which run on planking.

The shovel is provided with a wooden dipper handle 34 feet long and a steel-armored dipper of 2 yards capacity may be utilized if desired. A trench 7 feet wide was excavated with an average depth of 14 feet by the shovel as shown in Figs. 1 and 2, the average work done per day being 210 lineal feet of sewer or about 735 yards of excavation, as for every lineal foot of sewer about 3½ yards of earth had to be removed. Every half hour the shovel would move ahead about 14 feet, requiring about ten minutes in moving for each twenty minutes of work in trenching.

It is stated that the daily cost of operation is about $34.50 for the shovel service, including engineer, craneman and fireman, together with six laborers and the cost of three tons of coal, this giving a net cost per foot of about 16 cents for the 210 feet of excavation completed per day of eight hours.

It is stated that the sheeting and bracing cost 4.6 cents per foot and the invert 31 cents per foot, while the arch cost 38 cents per foot. The general expenses, removing and piling, make the total cost of the sewer $2.105, not including insurance, superintendence and losses on account of weather and accidents.

It is said that these items nearly double the cost, or that the actual total cost was about $3.90 per running foot of completed sewer. It is maintained that the concrete sewer is economical in the long run, as the cost of maintenance is extremely low.

MUNICIPAL FRANCHISES.*

By Charles Carroll Brown, Chairman of Committee, Indianapolis, Ind.

THE most promising development of recent years, in respect to municipal franchises is to be found in the laws passed by several states, placing the financial operations and the quality of service of public service industries under the supervision of state boards, composed of competent men, and served by experts in the various fields in which these industries are operated.

One of the principal difficulties in the past has been the ignorance of the ordinary municipal officials of the technical side of the operations of such companies and their neglect to apply the most common business principles to the formulation of franchises and contracts for service. It is practically impossible for any but the largest cities to expect expert service in these matters from the municipal officials and the assistance which experts, employed for the purpose, can render is often nullified by the action of politics or personal considerations.

The effect of the state board control of certain phases of the companies' activities is to overcome some of the disadvantages under which cities have been laboring on account of errors made in the granting of charters in past years, and when new contracts and charters are formulated the experience gained through contact with the state's experts, and the advice obtainable from them will certainly have its effect upon the provisions in these instruments.

In the past most franchises have been given away, and from some points of view, and in many cases this has been an eminently proper mode of procedure. Where the mistake has been made is in making the contract indefinite, or perpetual, with insufficient provision for revision of any of its provisions, so that on the one hand the municipality suffers under changed conditions, and on the other hand the company has cause for complaint. Unfortunately it is usually possible for the company to obtain relief from the city, but the company is seldom willing to relieve the city in case the contract turns out to be unfavorable to it. The value of the franchises which the city grants is discussed in one of the papers presented to this convention through this committee.

*A paper before the American Society of Municipal Improvements.

English cities, under the guidance in part of the Local Government Board, which is the central body supervising their operations, have inserted in franchises and contracts, granted by them, some valuable provisions, some of which have been included in the modern municipal franchise described in a paper presented herewith by a member of this committee. Such franchises as this one show progress in the terms of franchises and contracts, which is encouraging, even if it is slow.

Both the improvement in the terms of franchise and the control of operations under those granted recently and formerly promise amelioration of the existing conditions. The improvement in the states operating under laws providing for state supervision, and in the cities in which the modern franchises are in use will soon begin to show itself sufficiently to induce extension of the same principles to other states. It is well to hasten slowly, for opinions differ as to the details of application of accepted principles, and even upon some of the principles, and a few years' experience is needed to weed out the unfit, and to show the effect of local conditions in modifying methods and results.

THE MUNICIPAL WATERWORKS OF HAVERHILL, MASS.*

By Albert L. Sawyer, Water Registrar.

IN 1884 owing to the dissatisfaction of some of the larger water takers with rates, an agitation was made looking to the purchase of the plant by the city, under the act of 1867. Hearings were held by a committee of the city government, but nothing was at this time done. In 1890, however, another committee was appointed, with an appropriation of $500, to investigate and report on the advisability of acquiring the property and franchises of the Aqueduct Company. After an exhaustive hearing, the formal order of taking was passed by both branches of the city government, and the order was approved by Mayor Burnham, July 10, 1891. By this order the mayor was directed to apply to the Supreme Judicial Court for the appointment of three commissioners who were to determine the price of the franchise, rights and property of the company. The court appointed Hon. George O. Shattuck, John E. Sandford and Weston Lewis as commissioners. They held their opening session May 14, 1892, and on the 17th day of October, 1892, the commissioners reported that the price to be paid by the city was $637,500 with interest from the 6th day of July, 1891; the city was also to pay the fees of the commissioners, which were fixed at $7,655.

The Aqueduct Company was represented by Hon. Wm. Gaston, E. T. Burley, Esq., Boyd B. Jones, Esq., and Frederick E. Snow, Esq. The counsel for the city were Hon. George D. Robinson, Hon. Wm. H. Moody and Edward B. George, Esq. The total cost to the city of the hearings, including experts and counsel fees, was about $22,000.

The authority under which the works were taken by the city and have since been conducted, was an act of the Legislature passed in 1891, and two supplementary acts passed in 1892 and 1896. These acts were drawn by Hon. Wm. H. Moody, now one of the justices of the Supreme Court, who at that time was chief counsel for the city, and on the formal taking of the works was appointed one of the water commissioners. The original act was different from other acts regarding water supply in several particulars. Mr. Moody writes me that "the main purpose which he sought to accomplish, carrying out in this respect the wishes of the mayor and city council then in office, was to separate completely the water department from all other affairs of the city. It was hoped thus that the department would be managed upon strictly business principles without regard to politics. To that end it was provided that the water commissioners should be appointed for a term of five years, that only one should be appointed each year, and that the city be left to pay for the water which it used like any other consumer. The power of management of the department was vested exclusively in the commissioners, subject to removal by the city council for cause."

*From a paper before the New England Water Works Association.

Mr. Moody further writes that "in the act of 1892, which referred to the taking of lands for the protection of the water supply, he put into it the provision that any land taken for the protection of the water supply might be managed, improved and controlled by the water commissioners in such manner as they should deem for the best interests of said city. The purpose of this provision was to enable the land thus taken to be used for the purpose of a public park, and it has since been. I hoped for good results, but I did not realize that the result would be a most beautiful park in which all our people may justly delight."

Under this act the water board has taken 623 acres of land at a cost of $157,432, the larger portion of this being about the storage basin and Kenoza Lake. A portion of this is placed under the control of the park department at the discretion of the water board.

For five years the city paid for the water used in all public buildings and drinking fountains. Then came the same trouble that so many water works have had to meet, a city council short of money and the question raised as to why, as the city owned the works, any rates should be paid. The matter dragged along for several years, but no adjustment was ever made and the city has since then not paid a penny for water. In our case it has seemed particularly unjust, since not a dollar has ever been paid by the city towards buying the plant, operating it or toward the sinking fund. We charge the owners the entire cost of putting in the service, and the city pays all bills of this kind done for the different departments of the city.

Early in 1882 Haverhill was visited by a disastrous fire, that reduced almost the entire "shoe district" to ruins. The next year the city council appointed a committee on water supply, authorized "to cause to be laid by contract or otherwise cast iron pipe 12 inches in diameter, to be connected at the North Church with the high service pipe of the Haverhill Aqueduct Company." This pipe was to be used exclusively for fire service, and was laid through the main streets of the city, taking in the retail section and that portion occupied by shoe factories. An appropriation of $30,000 was made, covering the cost, and the work was done under the direction of the committee.

As the manufacturing district has expanded, calls have been made for extension of the high service in various parts of the city, to be used exclusively for fire protection, and appropriations have been made by the city council, the water department doing the work.

The hydrants are all under the control of, and are furnished by the fire department, but are set by our department and the expense paid by the city.

The water commissioners have the right to fix the water rates. The income, after deducting all expenses and charges of distribution, is applied, first, to the payment of the interest on the bonds; second, to the payment of the sinking fund requirements (2 per cent of the total amount of the bonds); third, to the payment of all current expenses; fourth, the balance, if any, may be applied to the sinking funds in the discretion of the commissioners. We are also allowed to expend not exceeding $20,000 in any one year for the purpose of new construction. In case the surplus should not equal the 2 per cent required for the provision of the sinking fund, the city must raise such sum by general taxation.

Our department receives all money from rates, etc., and pays its own bills, the only connection with the city being the appointment of a commissioner each year by the mayor, the auditing of the books of the department by the city auditor, and the payments for interest and sinking fund which are made to the city treasurer. The result aimed at has been achieved, the department having been so far kept entirely out of politics.

None of the commissioners, with the exception of the chairman, receives pay, and up to the present, the members of the board have all been leading citizens who have given freely of their time, and have been reappointed as long as they desired to remain upon the board.

The improvement and development of the system since its acquisition by the city has been on the lines laid down by the consulting engineer, the late Freeman C. Coffin, who in January, 1895, submitted an exhaustive report on the needs of the plant and sources of additional supply, and the result is a system fully equipped and capable of supplying an abundance of pure water at a cost to the consumer comparing favorably with other cities of the country. At the present time, a large section of the city is supplied by gravity from Crystal Lake, Round Pond and Lake Saltonstall. Kenoza Lake supplies those portions of the

city that are dependent on high service, and also furnishes water for the fire service, the water being pumped to a reservoir of 9,000,000 gallons capacity, built in 1898. As an auxiliary supply we have Millvale storage basin, which was built in 1894-5 by damming East Meadow river, and which has a capacity of 118,000,000 gallons. A Worthington engine with a capacity of 8,000,000 gallons per day is installed at Millvale, and the water is pumped through a 24-inch pipe into Kenoza Lake, a distance of one mile, as required, to keep that lake at a proper height. A 16-inch pipe connects Kenoza Lake and Round Pond. At the new Kenoza station, erected in 1900, are two pumps—one made by the Barr Company of Philadelphia, with a capacity of 6,000,000 gallons, and another of like capacity made by the Platt Iron Works Company, of Dayton, Ohio.

In 1896, the town of Bradford, situated on the south bank of the Merrimack river, was annexed to Haverhill, and the water board took in charge the water system of the town, which had been installed by Messrs. Goodhue & Birnie of Springfield as a private enterprise, and was later taken by the town. The water for this portion of the city is furnished from Johnson's Pond with an area of twenty-two acres, and is all high service, pumped to a reservoir of 1,000,000 gallons capacity by a 2,000,000-gallon Deane pump. The water board is about to install a second pump at the plant and eventually will probably lay a pipe across the river, which would be of use to either section in case of emergency.

We supply an estimated population of 37,600, our consumption being 134 gallons per day to each consumer. This high consumption is due to the fact that outside of the business portion of the city, the use of meters has been optional, and at the present time we have in use only 800 meters.

We have eighty-four miles of main pipe, cement lined and cast iron, ranging in size from 2 to 24-inch. The pressure on the low service ranges from 35 to 40 pounds, while the high service is from 80 to 120.

The original cost of the works in 1891 was $720,504.17. The cost of the works December 1, 1907, which of course includes all the improvements above mentioned and the land purchased, was $1,446,594.51, while the net debt at that same date was $646,-491.

And in addition, what is after all of the most importance to the water takers of the city, is the fact that since 1892 the rates have been year by year decreased. After several reductions in the tariff of rates, the commissioners adopted the policy of a discount of 5 per cent for prompt payment of bills, and this has been increased to 10, 15, 20 and 25 per cent.

MOUNTAIN CREEK DAM, GREENVILLE, S. C.
Equipped with Meter and Rate Controller.

EDITORIAL COMMENT

The Conventions in the Cement Industry.

A Northern Indiana Sanitary District.

Fair Rates For Water Service

THE CONVENTIONS IN THE CEMENT INDUSTRY.

It is probable that six conventions or exhibitions will be held in various parts of the country this year in the interests of various sections of the cement industry. This is a great development in the four years since the first convention was held in Indianapolis as a consequence of the efforts of MUNICIPAL ENGINEERING. When the promotion of the convention was first undertaken, the demand seemed to come mainly from what was then the newest application of cement to building construction, the makers of blocks, with some response from sidewalk men and users of massive concrete. The association formed at that time was largely composed of block makers and block machine makers and has developed into a sort of annual school of instruction for the newer men in the work who are asking for information. That this kind of work was needed is shown by the many failures in the block trade, due to the ignorance of the men early in the field, the misleading by the block machine promoters who saw only the immediate profits from the sale of machines, and by the considerable number of interested men who gather each year to listen to the practical instruction of the experts on the programs of the association.

Immediately following this first successful convention came two local conventions, which have continued each year with profit to the members of the associations and, in one case at least, to the business promoters of the meetings.

No one association could cover the whole concrete field, any more than it could cover the whole country. So, out of the successes and the failures of the Chicago convention of the National Association, grew the great Chicago cement show, which in the able hands of its sponsors bids fair to be as permanent as it is successful.

The South has held one small convention and may be able to gather another together this year.

The latest in the field is the Canadian convention, which bids fair to be as successful in its territory as the Northwestern in Minneapolis.

Then there is the permanent exhibit of the Concrete Association of America, a small body, which is doing the most persistent work of any in advancing the cause of good construction in concrete.

Five and possibly six of these conventions will be held in the next three months, and it will be well worth the while of every reader of MUNICIPAL ENGINEERING to attend at least one of them. The National Association of Cement Users meets in Cleveland, O., January 11-16, the Chicago Cement Show is held February 18-24, the Northwestern Cement Products Association holds its convention March 2-4 at Minneapolis, and the first Canadian meeting is called at Toronto for March 1-6. The Iowa association holds its conventions usually in February, but no announcement of this year's meeting has been received, nor has the Southern convention date been announced.

Whatever the title of the association, it draws most largely from the vicinity of the city in which the convention is held, and a national association is national only in its aims and desires and in its history as a whole. The N. A. C. U. is a traveling school with an almost entirely new class of students each year, and, allowing for the general advancement in the industry and the development of new uses of cement,

must, to a considerable extent, repeat its lessons each year, formulating them for more careful home study whenever this can be done. As long as it does not attempt too much it will be successful, and at the same time it will not meet the needs of all classes of cement users and so will indirectly lead to the formation of other associations to meet the various demands as they become strong enough to enforce recognition. Chicago is such an offshoot. The Northwestern, Iowa, the Southern and Canada associations were formed because a national association can not cover all the territory, and these districts require the annual gatherings, and the national conventions are too far away to supply them.

There is room for still more such associations and for them all to prosper.

A NORTHERN INDIANA SANITARY DISTRICT.

The report on the Michigan City water supply, an abstract of which appears on another page, gives rise to some interesting inferences and suggestions. It hints the insufficiency of the methods of disposal of the sewage of the southern parts of Chicago and of the rapidly growing sections of the State of Indiana adjacent thereto and in the basin of the Calumet river, but shows that as yet a city as near to this district as Michigan City is not affected by the serious pollution which the lake is receiving west of it.

The same experts who made the investigation of Michigan City have also studied the problems farther west as well as east, within the State of Indiana, and, to preserve the conditions where they are good as well as to improve them where they are becoming unbearable, they show that the increase in sewage pollution must not be permitted, and, in fact, that that already reaching the lake must be reduced if the water supplies drawn from the lake for the same region are to be rendered safe.

The subject has been discussed quite thoroughly by representatives from the various municipal and county organizations and the corporations affected and the State Board of Health, and some form of legislation will undoubtedly be offered to the State legislature for its action in the session which begins immediately after January 1. The lake front in Indiana is about 40 miles long and the drainage area tributary to it is not large so that practically the whole of that area could be included in a sanitary district similar to that of Chicago, and the problems within it could be studied together and solved with the least loss of time and energy and the maximum efficiency. As above stated, they are largely local, and if Chicago takes care of its share of the Calumet region as well as of its other drainage outside that watershed, the Indiana sanitary district can take good care of itself.

It is not probable that a drainage canal would be used to turn the sewage from the lake, although some form of canal or underground channel to the south might not be impossible, so that the district must turn to sewage purification for its improvement. Practically the whole area is sand and is occupied by little except the manufacturing and business centers that have been founded in consequence of the proximity of the region to Chicago and the junction of lake and rail transportation. It will not be necessary, therefore, to restrict the consideration of sewage purification to septic tanks and filters. Indeed, it may be found that the use of waste tracts for some form of land treatment will result in an increase in the value of the land for agricultural purposes which, added to its proximity to daily markets, will offset a considerable portion of the expense of operation.

An organization similar to the Metropolitan Sewerage Commission of Massachusetts can cope successfully with the sewerage and drainage problems of the district and find the money necessary for the construction of the works without interfering with the other activities of the corporations within the district. It can do this far more successfully than can the sepa-

rate corporations, which range in size from a few thousand to the hundreds of thousands expected in the new city of Gary.

FAIR RATES FOR WATER SERVICE.

In a paper before the conference of water works men with the Indiana State Board of Health, which was published in MUNICIPAL ENGINEERING, vol. xxxv, p. 73, the writer discusses the effect of the imminent necessity of purifying many water supplies upon the cost of supplying water, and the consequent probability of an increase in rates. He calls attention to the fact that most of the rates already in use are unscientific, not uniform, and indiscriminately correct, too high or too low, without any system, and suggests that the making of new rate cards in municipal plants and of new contracts of water companies with cities gives an opportunity for the proper study of the problem and a revision which will reduce the rates to a scientific basis, thus, possibly, not reducing rates except those which are already too low in comparison with the others on the card.

The principles governing the preparation of such a rate card are not considered in the paper, on account of limitations of space and time. They are taken up in detail in a paper presented on December 2 before the American Society of Civil Engineers by Leonard Metcalf.

The author takes two decisions by Judge Savage of the Supreme Court of Maine as the basis of his argument and works out a skeleton of an investigation of the cost of a water works and of operating it, and of determining all the other items which go to make up the total outgo which must be met by the revenue from the works. He thus covers the debit side of the problem very thoroughly in the 73 pages occupied by the paper. With a meter system the credit side can be very readily determined. With a flat rate system the discussion must be carried into the sufficiency of the various rates proposed for the various fixtures, services and combinations.

It is not possible to cover Mr. Metcalf's discussion thoroughly here, and reference should be made directly to it, as well as to Kiersted's earlier paper on the "Valuation of Water Works Property," also to be found in the proceedings and the transactions of the American Society of Civil Engineers.

The court's decisions covered such points as the following:

Actual construction cost affects reasonableness of rates but is not conclusive. Higher or lower present prices would cause gain or loss in value of property. Going and franchise values must be considered, also interest during construction period. The reasonableness of rates relates to both owner and customer, but in any event they must be reasonable to the customer. Profits exceeding a fair return on the property and franchise involve unreasonable rates. Charges cannot be greater than value of service even if the return is inadequate. The natural advantages must accrue to the benefit of the community, i. e., one company cannot charge high rates because another with a more expensive source charges them.

Mr. Metcalf's list of data required fills nearly seven pages, and covers history, legal rights, physical plant, operating statistics, value of structures, real estate, etc., lawful rates, going value, franchise value.

Original and reproduction costs, depreciation, sinking fund, land and water rights, liability for inefficient fire service, going value, franchise value and the measure of fair rates are all quite fully discussed. The corporation is said to have the right to fix rates which will earn:

1. Full operating expenses and repairs.

2. Depreciation or renewal fund sufficient to keep the plant fully replaced.

3. Interest on the capital, including the hazard in fixing the rate.

4. Interest on the reasonable profit increment assumed as compensation for undertaking the service.

5. A sinking fund if approved by the public, a question of the distribu-

tion of the burden of construction rather than its amount.

Numerous extracts from the court decisions are given on these points and others.

The author applies the principles and the method to the valuation of a certain plant, to determine whether the present income will pay a proper return on the capital involved.

The court's inclusion of the franchise in the value of the plant is contrary to the tendency of the times. Massachusetts eliminates it by statute. So far as the franchise grants a monopoly it is public property and the public should have the benefit of the increase in its value. Going value is really closely related to franchise value and should be considered with it. Going value comes from development of the business. It is made up of the cost of getting the business and the ability of the managers of the plant in getting and keeping it and developing it. Going value affects franchise value and in turn is affected by the monopoly factor in the franchise value. Appreciation in going value should inure to the benefit of the company, while appreciation in franchise value should come to the public, which should not be required to pay interest upon it. Sinking fund and depreciation charges have a similar inter-relation which is lost sight of if both are charged at their full values, and the public in that event pays too high a percentage on the capital. Some extracts from statements of English practice in these two respects are given by Mr. Metcalf.

A number of the questions require answer under local conditions and the principles stated in brief from court decision must be applied with judgment in view of all the facts. Such discussions as this by Mr. Metcalf are illuminating and will help to clear up many dark places in the numerous discussions of this subject which must arise in the near future, some because of the necessity for increase in rates to meet the increase in cost of service due to purification and some because the old open franchises will sooner or later get into court on the question of reasonableness of rates and their present apparently unrestricted powers to fix rates will be curtailed and should then be put upon the scientific basis which is gradually being laid.

THE QUESTION DEPARTMENT

Ordinances and Specifications Governing Sidewalk Construction.

I would like forms of ordinances requiring sidewalk construction at expense of owners of abutting property, making of special assessments and levy and issue of tax-bills for the same. Also specimen forms of plans and specifications for the construction of Portland cement sidewalks. These matters must be considered from the point of view of the Missouri statutes or the statutes of States having similar laws regulating fourth-class cities.
J. D. G., Salem, Mo.

The forms of ordinances vary with the State laws. The simplest forms are those in the States which give the board of public works or the council acting as such board the authority to institute the proceedings, construct the sidewalks and make the assessments. Thus in Indiana the common council of the smaller cities or the board of public works in the larger cities pass declaratory resolutions in form similar to the following:

"Resolved by the common council of the city of ——— that it is desired and deemed necessary to make the following public improvement, to wit: (Here describe the improvement and its general location).

"That there be and is hereby ordered constructed a part of said improvement known as ———, which part shall be

constructed along the following route and on the following streets and alleys, to wit: (Here describe in detail the exact location of the sidewalk ordered constructed, width, material, etc.)

"The territory to be assessed for the cost of said improvement and its construction is as follows, to wit: (Here describe the lots and lands upon which the assessment will be made).

"All work done in the making of the said improvement, including the said described district, which is now ordered, shall be done in accordance and in strict compliance with the instructions to contractors, terms and conditions of the improvement plans, maps, profiles, detail drawings, and specifications, marked ———, each and all of which are hereby adopted, and are hereby made a part of this resolution, and which are on file and may be seen in the office of the city clerk of ———.

"That the common council has fixed and does hereby fix the ——— day of ———, ———, as a date upon which remonstrances may be filed or made in person, by persons interested or affected by said proposed public improvements, and on said day at ——— o'clock ——— the said common council will meet at the council hall in said city for the purpose of hearing and considering any and all remonstrances which may have been filed, or which may be presented, and will hear all persons interested, or whose property is or may be affected by said proposed improvement in said district, and will also hear and determine the question as to whether such district or area is properly bounded for the purpose of such improvement, whether other territory not included in such boundaries should be added to such district, or whether any of the real estate therein included should be excluded therefrom, and will also hear and determine the question as to whether the special benefits to the several lots and parcels of land within such area and to said city by reason of such proposed improvement will equal the estimated cost of said improvement."

This document can be put in ordinance form in those States in which that form is required, and the specifications for the work can be included in the ordinance in the States in which this is required. The above is probably the simplest form that has been devised.

In several States sidewalk improvements are put upon a different basis from other street improvements, the sidewalk being apparently considered as the private property of the owner of the lot abutting on it, rather than public property in the same sense as the roadway. There does not seem to be any good reason for making this distinction, but it is still made in some States. Where this is so it is deemed necessary to notify the property owner to repair or construct his sidewalk, the fixing of grades and in most cases of the character of the sidewalk being assumed by the city under its general police powers. The notice fixes a date for the completion of the work and states that if it is not done by that time it will be done by the city at the expense of the property. Following is a skeleton of an ordinance covering all parts of the proceeding:

An ordinance in relation to sidewalk improvements and repairs and providing for the assessment and collection of the cost and expenses of such improvements and repairs, and for the enforcement of the lien created thereby against the real estate charged with any portion of such cost and expenses.

1. Classifies sidewalks in four classes.
2. Gives specifications for class 1.
3. Specifies widths of walks in various streets.
4. Gives specifications for class 2.
5. Gives specifications for class 3.
6. Gives specifications for class 4.
7. Provides for establishing of grades for sidewalks in classes 1 and 2 when ordered.
8. Whenever the common council shall in pursuance of the charter of the city, order and require any sidewalk to be made or repaired, an order shall be passed directing and requiring such sidewalk to be made or repaired, and if the order require a new sidewalk to be made, such order shall state whether such sidewalk shall be of class 1, 2, 3, or 4. Said order may include any number of lots or parts of lots, or other pieces or parcels of ground on the same street, or such order may, in the discretion of the council, only include a single parcel of ground. And the order shall designate the parcel or parcels of ground in front of or adjoining to which said improvements or repairs are to be made, either by the number of the lot or block, or by specifying certain points on the streets on which such sidewalks may be situated.
9. It shall be the duty of the clerk, as soon as practical after the passage of such an order, to cause a notice thereof to be posted in some newspaper printed and published in the city. But where the owner or claimant of said real estate is a resident of the city, the clerk may, in lieu of notice of publication, give written or printed notice to said owner or claimant by causing the marshal to deliver a copy of said order to said owner or claimant, which notice shall be signed by the mayor and attested by the clerk, and at any time within 30 days from the publication of such order, or serving of said notice on the owner or claimant by the marshal, the owner or claimant of any lot or parcel of ground embraced therein may make the improvements or repairs required by such order in front of or adjoining the premises of such owner or claimant. But such improvement or repairs shall be made in strict conformity to the requirements of such order, and if

thus made within the 30 days aforesaid, no further action of the council, as to the premises of such owner or claimant, shall be based upon such order: Provided, however, that if such owner or claimant shall within said 30 days have made a bona fide commencement to do the work required, and shall be diligently prosecuting the same, the council may, in its discretion, grant to such owner or claimant further time for the completion thereof. But if such owner or claimant shall not within said 30 days have commenced to do the work required by such order, it shall be unlawful for him to do the work or cause it to be done, or in any manner interfere with the person or persons employed by the city to do the same; and provided further, that if said owner or claimant shall construct or cause to be constructed any sidewalk, or make any repairs thereon in pursuance of any such order, either before or after the said 30 days, and such improvements shall not be in accordance with the requirements of such order and the provisions of this ordinance, it shall be the duty of the person or persons who may be employed by the city to make such improvements and repairs, to remove such sidewalks, provided the same be of a lower class than ordered by the council, and construct a sidewalk instead thereof, in strict accordance with such order and provisions of this ordinance.

10. Provides for construction of walks by mayor and city surveyor within 6 months if not done by owner in the 30 days, the mayor to make a written report to council of the entire cost and expenses in detail for each lot in aggregate and per front foot.

11. Provides for recording report and apportionment and issue of order by council making the assessment of cost and expenses on the property affected.

12. Provides for the issue to the contractor of a separate precept for each lot or parcel of real estate, describing lot and giving amount of assessment and empowering the contractor to collect the amount in his own name.

13. Provides for delivering the precepts to the contractor.

14. Provides for the issue of not more than 85 per cent of the cost in precepts as the work progresses.

15. Gives the contractor lien on the real estate similar to mortgage lien and similarly enforceable to the amount of precepts.

16. Provides for annual advertisement for bids for construction of all sidewalks to be laid during the year and prescribes terms of contract.

17. Disclaims liability of city for any part of the construction.

18. Repeals conflicting ordinances.

Methods of paying contractor, collecting assessments, giving notices, enforcing collections, differ according to the statutes in the various States.

Full specifications for laying sidewalks will be found in the "Handbook for Cement Users" ($3), showing the variations in methods in various cities. Full specifications will also be found in MUNICIPAL ENGINEERING, vol. xxxi, p. 104. Articles giving additional information on the subject are given in vol. xxx, p. 8, and vol. xxxii, pp. 24, 25, 177, 179, and 181, and in vol. xxxiii will be found a long list of previous articles on the same subject.

Several of the cement companies have pamphlets for distribution giving good specifications for Portland cement walks, such as the Marquette, Dexter, Sandusky, Atlas, Alpha, Universal, etc., a full list being printed in the "Business Directory" in each number of MUNICIPAL ENGINEERING under the heading "Cement."

Books on Macadam Road Building.

I wish you would let me know through your "Question Department" the name of some book or paper on macadam roads, dealing with estimate of quantities and cost as well as general information.

F. L. M., Harrisonville, R. I.

Probably the best book on this subject is Byrne's "Highway Construction" ($5). If our correspondent has access to the transactions of the American Society of Civil Engineers, he will find a lengthy discussion on maintenance of macadam roads which describe some of the new methods and materials now under experiment.

Efficiency of Concrete Pavements.

We are in urgent need of reliable data bearing on the general efficiency and utility of concrete pavements for municipal and highway purposes. Knowing that your concrete department has complete data on this subject, we write requesting you to send us a list of localities having experience with this class of paving. Any data you may be able to favor us with in this connection will be greatly appreciated.

S. B., Fargo, N. D.

MUNICIPAL ENGINEERING has a full collection of data on this subject and a number of articles discussing the advantages and disadvantages of concrete pavements. Following are the principal articles which have appeared during the past two years:

The new pavement at Bozeman, Mont., is described in vol. xxxv, p. 389; the Blome pavement on p. 367; the new Allentown pavement on p. 254.

An article in vol. xxxv, p. 180, gives an account from the former city engineer of the difficulties with the pavement at Bellefontaine, O., and what was done to overcome them. The earliest of these pavements was laid some 16 or 18 years ago and is still in condition for daily use. This article may serve as an answer to the questions of our correspondent. On p. 36 is a description of pavements laid in Kottbus, Germany, which have been in successful use for 10 years.

Articles in vol. xxxiv, p. 336, on the

evolution of pavements, and p. 329 on municipal engineering at Gary give additional discussions and comparisons of concrete and other pavements. One on p. 357 gives a list of cities having concrete pavements, and one on p. 168 gives specifications for Richmond, Ind., pavements as well as considerable information about durability and suitability. A list of cities having concrete pavements will be found on p. 357.

In vol. xxxiii, p. 412, is a description of the concrete pavement in Le Mars, Iowa, in successful use for 3 years.

Short notes on various points will be found in vol. xxxii, pp. 173, 252, 303 and 317, and a list of previous articles on p. 89.

There are so many cities with concrete pavements now that it is difficult to make a complete list. Those in this country concerning which there is more or less information on file are the following, most of the names being collected from the above named articles: Bellefontaine, O.; Grand Rapids, Mich.; Toronto, Ont.; Richmond and Gary, Ind.; New Orleans, La.; Le Mars, Iowa; Washington, D. C.; Calumet, Houghton, Hancock and Kalamazoo, Mich.; Chicago and Kewanee, Ill.; Atlanta, Ga.; Denver, Colo.; Allentown, Pa.; Bozeman, Mont.

The "Handbook for Cement Users" ($3) contains the most important parts of the earlier articles in MUNICIPAL ENGINEERING.

Secretary of N. E. Water Works Association.

Please give the name and address of the secretary of the New England Water Works Association.

A. M. FISHER, City Engineer,
Coshocton, O.

Willard Kent, Narragansett Pier, R. I., is secretary of the New England Water Works Association.

Rates for Lighting and Contract Provisions.

Granting street privileges to a water power company to furnish street lights to town and to residences and power for any future enterprise, what should be the maximum rates and what the conditions of the contract? H., Lancaster, S. C.

These are questions which can be answered definitely only after a study of the local conditions. This is shown by the variations in the rates charged for the same or similar service in various towns. The following information regarding rates in villages in New York of 1,000 to 3,000 population illustrate this:

Of 11 villages reporting rates for commercial arc lighting, 1 charges $90 a year per lamp; 1, $75 for a 6-ampere lamp and $54 for a 4-ampere lamp; 1, $72; 1, $65.70; 1, $65 to $50; 1, $55; 1, $54 to $42; 1, $50; 1, $48; 1, $42, and 1, $30.

From 57 villages reporting commercial rates for incandescent lighting the following table is prepared:

FLAT ELECTRIC LIGHT RATES IN NEW YORK VILLAGES.

No. of Villag's Reporting.	Maximum Rates.	Minimum Rates.	Candle Power of Lamps.
1	$15.00	$9.60	max. for 25 c.p.
1	15.00	6.00	
6	12.00	6.00 to 12.00	1 for 25 c.p.
2	10.95	9.12 to 10.95	
2	10.80	6.00 to 10.80	1 for 25 c.p.
2	9.12	1.82 to 9.12	
3	9.00	5.56 to 9.00	
1	8.40	6.00	min. for 8 c.p.
3	8.00	2.00 to 8.00	
1	7.80	5.04	
1	7.50	7.50	
1	7.30	7.30	
6	7.20	1.80	
1	7.00	1.50	
17	6.00	1.08 to 6.00	
1	5.42	2.00	
1	5.40	1.08 to 5.40	
1	5.28	5.28	
2	5.00	2.00	
2	4.80	4.80	1 for 10 c.p.
1	4.20	4.20	
1	3.60	2.16	
2	3.00	2.00 to 3.00	
1	2.40	2.40	

If not otherwise stated, the lamps used are presumably 16 c.p., although some of the reports do not specify the standard lamp, and all rates are per lamp per year. A few villages fix minimum bills at 50 cents to $1 a month.

The meter rates do not compare any more closely. Nor do they seem to correspond with the flat rates; for example, in certain villages the flat rates are higher in one than in the other, while the meter rates are lower. Possibly some of these discrepancies could be explained by difference in standard lamps, but all of them cannot. The following table shows the variations in meter rates, all being in cents per kilowatt hour, and the minimum rates being those obtained by making the maximum deduction allowed for prompt payment and large quantity:

METER ELECTRIC LIGHT RATES IN NEW YORK VILLAGES.

No. of Villages Reporting.	Maximum Rates—Cents.	Minimum Rates—Cents.
10	20	6 to 20
1	18	8
1	16	16
18	15	7½ to 15
1	14	14
1	13½	12.15
2	12½	5 to 12½
14	12	6 to 12
1	11	9.95
21	10	6.7 to 10
6	8	2 to 8
1	7	4½
1	6 2-3	6 2-3
2	6	6
1	5	5

The minimum monthly bills are fixed in a few instances, in one at 50 cents; in three at 75 cents; in three at $1, and in one at $1.25. One adds a 5 per cent. pen-

alty after the 20th of the month. One makes the minimum $50 a year. One makes a discount only on a bill amounting to $5 and another to $15. One makes the minimum charge $1 a month per kilowatt of capacity. One charges a meter rent of 20 cents when the bill is less than $3 a month.

One of the plants charging 15 cents a kilowatt hour also charges at ¾ cent an ampere hour; one with 12 cents per kilowatt hour charges 1 cent per ampere hour, and another charges ¾ to 1½ cents an ampere hour. One charges 9 to 12 cents per candle power per year, and another charges 30 to 60 cents per candle power per year, one being very low and the other near the average for 16 c.p. lamps.

Rates for power are equally various, maxima being one at $108, one at $50, one at $40, three at $30 and one at $15 per horse power per year, and the minima varying between the same limits. Meter rates for power are in nine villages for maxima, respectively, 15, 10, 9, 8, 6, 5, 4, 2 and 1½ cents per kilowatt hour. Minima range between the same limits.

For public street lighting the rates are no more accordant. In 58 villages reporting arc light rates, 18 have an all-night schedule for lighting, running approximately 3,800 to 4,000 hours a year, a few giving more and a few giving less, down in one instance to $90 for about 3,000 hours. The prices charged in these towns run per lamp per year $105, $100, $98.55, $95, $91.25, $90, $85.78, $85 for 6-ampere and $70 for 4-ampere lights, $85, $80, $72.50, $70, $66, $65, $54.64, two $50 and $15. Six towns do not state the lighting schedule used, and their rates are $70, $60, $58.57, $55, $42 and $40. Sixteen use the moonlight schedule and pay $98.55, $75.85, two $75, $65, two $60, $58, $57.50, $56.58, four $50, $45 and $42. Five use the moonlight schedule to midnight, paying, two $55, $51.10, and two $50. Eight run lamps to 1 a. m., paying, four $70, $62.50, $60 on moonlight schedule, $50, and $40 on moonlight schedule. One runs to 1:30 a. m., paying $60, and two run to 2 a. m., paying $60. One village runs lamps 20 nights a month, paying $49.88 a year.

Some of these lamps are so-called 2,000-candle power and some 1,200, but many do not state the rating of lamps, and as this does not seem to make any difference in rates, no attempt is made at a distinction.

For incandescent lighting the rates are usually stated with the rating of the lamp. Following are the rates for the various lamps and lighting schedules in dollars per lamp per year:

RATES FOR INCANDESCENT STREET LIGHTS IN NEW YORK VILLAGES.

CANDLEPOWER.	55	50	40	32	30	25	20	16	Not Stated
All-Night Schedule		1-$24. 1- 16.56	1-$15.	1-$22. 1- 18. 1- 13.50 1- 8.	1-$15. 1- 10.	1-$25. 1- 23. 2- 22. 1- 20. 2- 19. 1- 18. 1- 15.60 1- 11.42	2-$20.	1-$18. 1- 16. 1- 15. 2- 10. 1- 5.60	
Hours of Lighting not Stated		1- $9.23			1-$12.50	1-$21.			1-$17. 1- 9. 1- 8.50 1- 3.
Intermediate Schedule						2-$21.25 1- 20. 1- 18.18	1-$15.		
Moonlight Schedule			1-$15.			1-$15.	1-$18.18 1- 15.	1- $8.	
Moonlight Schedule to Midnight	1-$15.			2-$20.		1- $9.			1-$10.
To 1 A. M.				1- $5.	1-$15.	1- $9.			
To 2 A. M.				1-$18.					1-$10.

The intermediate schedule of the table runs about 3,000 to 3,500 hours per year, lying between the ordinary moonlight and all-night schedules. The highest price in the 1 a. m. schedule is for a moonlight schedule. The others are not definitely stated as moonlight or every night. One village reports 8 and 16-candle power lamps in use at $6 and $12 a year, out at midnight, which is not included in the table.

Reference may be made to vol. xxxv for lists of articles on this subject.

A contract for street and public lighting which gives fairly good satisfaction contains the following provisions:

1. Defines the parties to the contract, such as city board of public works and lighting company.

2. Company to furnish a stated minimum number of lights and all accessories and operate them.

3. Period of contract.

4. Time set for completion of plant

and beginning of service and penalty for delay.

5. Quality of materials to be used.

6. Time that lights shall be kept in operation each day and provision for deduction for incomplete and improper lighting.

7. Company to replace defective lamps.

8. Supervision of work by board of public works provided for, also payment by company of inspectors at stated monthly salaries. Board can order changes in plant at any time for public or private convenience at expense of company or of party requiring change, as board may determine.

9. Company not to obstruct streets unduly during construction.

10. City reserves its police powers to regulate use of streets by company.

11. Company to observe all ordinances passed by council.

12. Board may change location or cut out lamps at will.

13. Board may order improved machinery and apparatus installed to reasonable extent and in reasonable manner.

14. Company assumes all obligations and dangers of city arising from construction or operation of its plant.

15. Fixes rates to be paid by city.

16. Payments to be made by city monthly, deducting forfeitures.

17. Park board may contract for lights if it so elects, provided that it shall take not less than 5 arc lamps or 20 incandescent lamps per mile of line required, and shall pay the same rates fixed in sec. 15, pro rata, for time light is furnished.

18. Company pays each year a percentage of its gross receipts to city.

19. Use of streets granted to company under provisions as follows:

a. Power stations.

b. Maps to be furnished of new construction, extensions and locations, and permits for work to be procured, using alleys as much as possible, and board to have right to locate all appurtenances; underground conduit district prescribed.

c. Excavations and overhead construction then permitted.

d. Underground conduit district may be extended.

e. Depth of conduits fixed, but not to interfere with existing authorized underground structures.

f. City appoints inspectors, to be paid by company.

g. Obstruction of streets restricted and damages consequent on construction and operation assumed by company.

h. Company to use most modern and effective appliances in generation and distribution of electricity, consumption of smoke and prevention of damage.

i. Company may tap sewers for drainage of structures by obtaining regular permit.

j. Bond for satisfactory compliance with provisions.

k. Date of beginning and completing construction work.

l. Maximum rate to be charged to private consumers.

m. Provisions for extending branch lines for private service on petition of subscribers for certain number of lights per stated length of line, and penalty for failure to complete such lines within time fixed by board.

n. Company shall supply without cost meters to consumers applying for them and complying with reasonable regulations approved by board of public works. No charge for renewals of lamps, etc., unless actually furnished, and not to exceed 10 per cent. of cost. Bills must show meter readings.

o. Company to pay stated percentage of gross receipts to city and city comptroller to have right to examine books of company to verify statements of receipts.

p. Limit of franchise or contract.

q. Detailed provisions for purchase of plant by city at expiration of franchise under various assumptions of conditions.

r. City can use company's poles to support city's fire, police and city telephone lines.

20. Contract does not interfere with prior rights in same line nor require reconstruction of existing plant, except to provide for operation of the new style of lamps required.

21. Company may, on approval by board, substitute other lamps for those prescribed in the contract under specifications to be adopted by the board, and without increasing cost per lamp to city.

22. Company to keep $1,000 on deposit with board of public works as emergency fund in case city is obliged to repair streets or defects in system caused by company's construction or neglect.

23. Company to observe all city ordinances.

24. Provisions for unavoidable delays.

25. Consent of board required for assignment of contract.

26. Specifications in full for the system, including types of lamps, underground and overhead service, minimum number of lamps, privileges and restrictions of ordering and discontinuing lamps, penalties for failures to follow orders, deductions for failures to maintain and operate lamps, in cents per day per lamp, specifications for lamps, underground work, lamp supporters, restoration of pavements, filing of maps, plans and specifications, and in general.

27. Form of acceptance of contract by city and company.

Not all of these provisions will be required for a small city or village.

There is much discussion at present of the method of measurement of light, especially for street lighting. The company produces electric current and the city purchases light, and the relation between the two is not fixed. The paragraph governing this matter must therefore be written

with the local conditions in mind. The method of measuring the efficiency of lamps must be prescribed on the same basis. Interference with shade trees should be specifically prohibited except by special permission of the board or officer having charge of them or of the streets; also, proximity of wires to existing or later constructed buildings or their appurtenances.

Crusher for Sandstone.

Will you kindly inform me where I can get in touch with a company which manufactures sand mills or crushers for crushing a soft sandstone? I think there is a machine for this purpose in which they use rollers. W. F. N., Meadville, Pa.

Jeffrey Manufacturing Company, Columbus, O.; Geo. V. Cresson Co., 141 Liberty street, New York; F. L. Smidth & Co., 39 Cortland street, New York; Austin-Western Co., 315 Dearborn street, Chicago, Ill., and Chambers Bros. Co., 52d near Lancaster avenue, Philadelphia, Pa. can supply the machinery required. Crushing rolls of various sorts and for various purposes are made also by Allis-Chalmers Co., Milwaukee, Wis.; Bonnot Co., Canton, O.; Power and Mining Machinery Co., Cudahy, Wis.; Wellman-Seaver-Morgan Co., Cleveland, O., and others. The Bradley Pulverizer Co., Boston, Mass.; Kent Mill Co., New York; Lehigh Car and Axle Works, Catasauqua, Pa.; Raymond Bros. Impact Pulverizer Co., Chicago, Ill.; Sturtevant Mill Co., Boston, Mass.; Williams Patent Crusher and Pulverizer Co., St. Louis, Mo., may be able to meet our correspondent's needs.

Makers of Hydraulic Rams.

Can you furnish me the names of some manufacturers of hydraulic rams or water wheels with pumps suitable for raising water through a vertical height of about 200 feet and an available head of 6 feet at least, with an efficiency of say 25 per cent? J. O. P., Muncie, Ind.

The Rife Engine Co., 111 Broadway, New York City, make a hydraulic ram, some description of and data concerning which will be found in MUNICIPAL ENGINEERING, vol. xxxiii, pp. 54, 127, 204 and 279. In the first article it is stated that the pump will lift water 25 or 30 feet for each foot of fall, so that it is probable this pump would be able to do the work desired.

Concrete for Railroad Bumper.

I would ask for information as to the practicability of using a concrete block as a railroad bumper in connection with my car stopper. This stops 99 per cent. of cars sent on it, but it is possible that a car may be, by accident, driven on at such speed as to carry it over or send the box over end of stopper. There are locations in which the results would be disastrous, and the railroad people are asking me to design a bumper to use in connection with the stopper at such places. Inclosed is a very crude sketch of a concrete block, reinforced with old rails.

I would ask if, in your opinion, the block would stand the blow. You understand that the retardation of the car is very great, and that the blow would be insignificant compared with what it would be if the stopper was not in front of it.

Also, I would ask if this block could be built at different points, such as Chicago, Detroit, St. Louis, New York, Philadelphia, Cincinnati, at a cost of $3.00 per yard or less.

D. P. S., Columbus, Miss.

The concrete would serve to give mass to the bumper, but would be subject to disintegration by successive blows of cars against it, so that the surface on which the blows strike should be protected by heavy timbers, or by timbers reinforced with steel bars and tied back to the track or to the car stopper itself. This concrete could hardly be put in place at $3 a cubic yard if made rich enough to give the proper solidity under shocks and smoothness of surface. The question of cost of forms is important for such small masses, and the cost of the concrete might vary between, say, $4.50 and $6, or even more, per cubic yard.

Color for Cement Blocks.

Do you know of a good formula for making colored cement blocks? I am designing a cement-block house that will require a good durable imitation brownstone block, and if I can get a block that will not fade I believe the design will be a success.

G. A. C., Twin Falls, Ida.

Iron oxides are the best colors to use for coloring concrete. They combine well with the cement and other aggregates. Browns and reds can be made with them. The exact color desired must be obtained by experiment, for the colors of the aggregates and of the cement have considerable effect upon the mixture. They can be obtained of the dealers in masons' supplies. An ordinary formula gives 6 pounds of roasted iron oxide for brown color and 6 to 10 pounds for red color, per 100 pounds of cement, and this will serve as a basis for the experiments. It may be found necessary to use part of each coloring matter to get just the shade desired. The "Handbook for Cement Users" ($3) gives some instruction on coloring matters.

Limestone in Concrete for Sewers.

We understand you published an article in your magazine a short time since in connection with the use of limestone in concrete for sewer work. We would be very pleased to receive a copy containing this article. We are interested in the construction of a large trunk sewer which is to be constructed of mass concrete, and we would like to know if limestone would be suitable for use in the concrete. We were under the impression that we had seen an article in your magazine which described a sewer in which limestone had been used in the concrete, and the results had not been satisfactory. We would

thank you for any data you might have along this line. Will sewage and sewage gases disintegrate limestone is really the question involved.

H. & M., Toronto, Ont.

There are several articles concerning the effects of alkali and acids upon concrete. The effects of alkali are produced, apparently, upon the cement and not upon the aggregate, the alkalies setting up some chemical action in the constituents of the cement which produce soluble salts and ultimate disintegration of the concrete. It is not understood that this affects the limestone in the concrete in the least. The action is as yet not well understood and observations are not yet numerous enough nor concordant enough to make definite the cause or the method of the actions which produce the results observed. The articles which have appeared in MUNICIPAL ENGINEERING on this subject will be found in vol. xxxv, pp. 385, 317, 114, 103, 102.

It will be noted that some of these articles refer to the effects of acids in the sewage upon the concrete. These effects are not observable except in a few cases where the discharge from some factory is very decidedly acid in its character. It is doubtless true that in such cases the limestone as well as the cement would be affected and the ultimate disintegration of the concrete would follow, whatever the aggregates in the concrete might be. In relation to this point there are articles on "Cement Sewer Pipe" in vol. xxxii, p. 263, and on "Effect of Sulphur in Concrete Aggregate" in vol. xxxii, pp. 24 and 447; also a brief answer to a question in vol. xxxi, p. 136.

See also the article in this number on "The Construction of a Reinforced Concrete Pipe Sewer in Wilmington, Del."

Cement for Chimneys.

I have looked through MUNICIPAL ENGINEERING to find some data for construction of house chimneys of cement, but have been unable to find anything on that subject. I would like to know if cement will answer for the purpose as well as brick, and if so if flues should be made of tile imbedded therein or galvanized iron pipe or if the flues will do of the cement only. Size of chimney, 16 by 28 inches over all and well braced.

SUBSCRIBER, Charlevoix, Mich.

Fire tests of concrete have been made and the results published in MUNICIPAL ENGINEERING show that concrete can be used without fear for house chimneys. Articles on this subject will be found in vol. xxviii, pp. 47, 332, 490; vol. xxix, pp. 120, 130, 188, 305; vol. xxx, pp. 1, 282, 339, 375, 391, 428; vol. xxxi, pp. 19, 398, 283, 170, 26, 448; vol. xxxii, pp. 30, 316; vol. xxxv, p. 387.

A method of making a concrete-block chimney is suggested in vol. xxviii, p. 382; vol. xxx, p. 282.

The making of large chimneys of reinforced concrete is discussed briefly in vol. xxvii, p. 372, and vol. xxx, p. 17.

Some instruction in building of concrete blocks a larger chimney than that in the question is given in vol. xxxv, p. 247.

The chimney may be built of blocks or of monolithic concrete, and in the latter case can be strengthened somewhat by putting in a few fence wires, barbed or not, say one near each corner. A block chimney, having hollows in the blocks of proper form, needs no lining for the flues. Neither does a monolithic chimney, but if hollow tile or iron pipe are used for the forms to make the flues they can be left in place. Wooden forms would be difficult to remove from the small flues if the chimney is built up as rapidly as it should be to get the most economical result.

Information About the Commission Form of Government.

Will you please give me all the information you have at hand on commission form of government, as exemplified in the Houston, Dallas and Galveston, Texas, plan?

JNO. A. M. MCRAE, City Attorney,
Charlotte, N. C.

Reference may be made to the following articles in recent numbers of MUNICIPAL ENGINEERING for information about the commission form of government and other articles will follow in later numbers:

"Plans for City Government," vol. xxxv, p. 169.

"Government of Cities by Commission," vol. xxxiv, p. 160.

"Business Administration Forms Demanded for American Cities," vol. xxxiv, p. 176.

"The Des Moines Plan Is Constitutional," vol. xxxiv, p. 177.

"Elective Town Meetings as a Form of Municipal Government," vol. xxxiv, p. 265.

"Success of City Government in Great Britain," vol. xxxiv, p. 288.

"New Forms of Municipal Government," vol. xxxiii, pp. 100, 244.

"The Defeat of the Proposed Chicago City Charter," vol. xxxiii, p. 246.

"The Galveston Plan of City Government," vol. xxxii, p. 255.

See also the article in this number on "Cedar Rapids Under Commission Government."

A Microscope Available.

In response to the inquiry in this department for the names of makers of microscopes, made by L. C. H., Bellingham, Wash., a subscriber in Indianapolis states that he has a very excellent instrument which he will dispose of at about half price.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

A House Numbering System.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Our city council has just passed an ordinance changing the system of numbering houses from the system which gives each block 100 numbers, with one number to each 25 feet front, to the system recommended by Mr. Ernest McCullough in his book, "Engineering Work in Small Towns and Cities." This system gives an odd and an even number for each 10 feet front, and starts from some point outside of the city, so that there are no "E." and "W." or "N." and "S." prefixes to the street names. It also has the advantage of causing no confusion when a new street is opened or an old one closed, which, according to the old scheme, would make a difference of one hundred in the numbers of all streets crossing the newly opened or closed street.

Our city is very irregular as to the size of its blocks, which introduces another objection to the old system, and a part of the streets are diagonal, some are curved, and some run parallel with the section lines. This caused a difference of two hundred in numbers directly opposite on the same street, while on a parallel street only a block distant the numbers were five hundred greater.

There is a strong objection on the part of the citizens to the change that has been made, and I would like to know the names of any towns that are using the system that has been adopted; and is there any system in use that would better serve our purpose?

I am inclosing a small outline map of the town showing the new system in yellow, with large black figures at the ends of the lines, and some of the numbers according to the old system in small black figures on the blocks.

The old numbers began at the river or at the south ends of north and south streets, and increased in a northerly direction, while on the east and west streets they increase both ways from Coteau street and Euclid avenue.

I am also inclosing a copy of the new ordinance, which may help to make my meaning clear.

ORRIN E. STANLEY, City Engineer.
Pierre, S. D.

The ordinance is as follows:

An Ordinance Providing for Numbering Dwelling Houses and Places of Business on Streets and Avenues in the City of Pierre.

Be it Ordained by the City Council of the City of Pierre:

Section 1. That the dwelling houses, business places and frontages on the streets and avenues in the city of Pierre shall be and they are hereby numbered, and the respective places of residence and of business therein shall be hereafter known and designated by number, within the limits hereinafter provided, as follows:

The initial point is hereby established, two miles south and two miles west of the southwest corner of section 33, in township 111, north, range 79 west of the fifth P. M. And all base lines run from this point north and east parallel to the west and south lines of said section 33.

Each ten (10) feet space measuring east and north from the base lines shall have two numbers, one odd and one even, the odd numbers to be on the right-hand sides of the streets and the even numbers on the left-hand sides of the streets, and directly north or east of the corresponding odd numbers. Diagonal streets to have the set of numbers used corresponding to the direction most nearly assumed by the street. That is, a street running more nearly north and south than east and west will take the northerly set of numbers. Curved street to use the set of numbers determined by their average direction.

Sec. 2. All houses in the free delivery district to be numbered with numbers of sufficient size, and to be of such color and so located as to be easily read from the street. And all dwelling houses to bear the number corresponding to the space on the street line, where a line through the center of the door, at right angles to the street line, intersects the street line.

Sec. 3. All certificates of correct numbers to be furnished by the city engineer, at a charge of 25 cents for each and every such number so certified to by said city engineer, and the same to be paid for by the person to whom such certificate is issued, as aforesaid. All dwelling houses and all business places, found to be correctly numbered under the provisions of ordinance No. 196, shall have such new certificate issued under the provisions of this ordinance free of charge. And all fees and charges for such certificates issued under the provisions of this ordinance, as aforesaid, shall be paid to the city auditor, and be by him paid over to the city treasurer, at the end of each and every month, same to be credited by said city treasurer to the general fund.

Sec. 4. All dwelling houses and other buildings required to be numbered under the provisions of this ordinance shall be so numbered within sixty days from and after same shall take effect. All buildings which may at any time hereafter be built within the city of Pierre, and subject to the requirement of being numbered, shall be so numbered within ten (10) days after such building shall become occupied, either as a dwelling house or place of business.

Sec. 5. Any person found guilty of violating any of the provisions of this ordinance shall upon conviction be fined in a sum of not less than five dollars and not more than fifty dollars.

Sec. 6. Ordinance No. 196, and all other ordinances or parts of ordinances in conflict with the provisions of this ordinance are hereby repealed.

Sec. 7. This ordinance shall take effect and be in force from and after its passage, approval and due publication.

Passed on this 2d day of November, A. D. 1908.

Approved on this 2d day of November, A. D. 1908.

L. B. WADLEIGH, Mayor.

Attest:

W. S. LITTLE, City Auditor.

The writer has had something to do with the numbering of houses in two cities and found a system similar to that above described very convenient. In Indianapolis ten blocks make one mile, so that with 100 numbers to a block, each number would cover approximately 9 feet of the block length after the street widths are deducted. Therefore 100 numbers to a block (50 on each side of the street) would correspond almost exactly to the system above described. One set of the streets in the city is numbered, and it is a very great convenience, therefore, for the house numbers in their hundreds to correspond with the street numbers. The system of 9 feet to a number is much better than the ordinary method of numbering the houses or doors on the block and then skipping the numbers that are left unused when the end of the block is reached. Outside the original city plat the streets are less regular. In those sections lines were drawn across the map, not at equal distances apart, but at as nearly equal distances as possible and have the lines follow streets for as much of their length as possible. The streets were numbered to correspond with their proximity to these lines, an extra street for a block or a few blocks receiving a name, so that a street with a given number would be at very nearly the same distance from the base line, wherever it might be found. When the imaginary lines cross blocks in which the numbered streets corresponding are missing, the change in the hundred in the house numbers is made where this line is located, and when the extra streets are found the numbers run through without reference to them. Because the hundreds in the numbers correspond reasonably closely with the standard of ten blocks to the mile, the assignment of 100 numbers to a block is more satisfactory than the assignment of 10 feet or any other fixed length to each number. This is emphasized in the section of the city in which the streets are numbered.

Diagonal and curved streets are treated as described in the above ordinance. Some of the curved streets are much more difficult to number than any in Pierre.

When the city is built up about a center, as Indianapolis is, there is considerable convenience in numbering four ways from that center, but very often the assumption of a center outside the city is good practice. The letter for the direction must be added to every number according to the former system, and all numbers will have at least four figures in the latter system, so that one offsets the other in convenience of writing, except that the direction letter is more easily lost. But the direction letter gives much clearer indication of the section of the city in which the house number is located.

Omaha, Neb., uses a similar system. The Missouri river is the beginning for the east and west series of numbers, and one of the main business streets is the dividing line for the north and south series. This system is very convenient for cities in this condition, although the streets next the river are likely to be very irregular, and, as in Omaha, the business center is in the vicinity of the sixteenth hundred. The river at Pierre could not be used as a base.

It should be noted that in Omaha the meanderings of the river affect the numbers of the first houses on the streets running to it, since the house numbers conform throughout in their hundreds to the names (numbers) of the streets.

The blocks in Omaha are shorter than in Indianapolis, so that the system of 100 numbers to the block gives less than 9 feet to the number. The streets parallel to the river are numbered, so that the system of 100 numbers to the block is again more convenient than 10 feet to a number.

The layout of streets is very irregular, although nearly all run with the cardinal points of the compass. Consequently it was impossible, in numbering the streets, to number every street without making them so close together that the hundreds would almost as a rule change in the middle of the blocks as well as at the streets. Therefore, many extra streets are found, and are called avenues. Thus the extra street found in some parts of the city between Twenty-ninth street and Thirtieth street is called Twenty-ninth avenue, instead of being given a name. The numbers in the twenty-ninth hundred run through from Twenty-ninth to Thirtieth street, without reference to Twenty-ninth avenue. The irregularity in distance between the imaginary lines drawn on the map to locate the streets having the same number gives rise to great differences in lengths of blocks. The attempt is made to distribute the numbers through the blocks, although on

some blocks this may give ten feet to a number and in others even less than five. This system is believed to be more satisfactory, notwithstanding its seeming irregularity, than the ironclad system of 10 feet to a number, for, after all, what is wanted is convenience to the man looking for the number, whose measure is the block rather than the tape line.

Without having tested the system described in the ordinance, the writer is disposed to believe that the modifications of it in use in the two cities named can be applied to any other city with a result of greater convenience to the hunter for a number than can any inflexible system.

The map prepared for numbering purposes in either of the cities named looks very much like the one prepared for Pierre, and irregularities in direction of streets are treated in much the same manner. The apparent difference is that the lines are not always strictly parallel and are not at uniform distances apart, although the departures may not be great in either respect. Many special cases arise which require special study, especially where a street has a considerable jog and still retains the same name; but if the hundred belonging to the cross-street is taken off the map properly and the principle of having consecutive numbers opposite or next to opposite each other across the street is adhered to as closely as possible, most cases will be taken care of readily and with very little departure from the exact demands of the system.

The writer has not seen the city of Pierre, but would judge from the map that the location of the center of numbers outside the city limits would be more than usually satisfactory, and that the center had been wisely chosen.

Perhaps some of our readers will offer their suggestions and report their experience.

Old and New Methods in Asphalt Paving.

To the Editor of MUNICIPAL ENGINEERING:

Sir: I read with interest Mr. Grant's article in MUNICIPAL ENGINEERING, vol. xxxv, p. 354, on "Old and New Methods of Asphalt Paving" in reference to the pavement on Douglass street, Omaha.

Mr. Grant asks if there has been any progress made in asphalt paving during the past twenty years, except the lower the price by laying poorer pavements. I can assure him that there has been decided progress, not only in the increased number of sources of supply of asphalts, but also in refining them and in the manufacture of asphaltic cements. There are many good for making good and durable asphalt pavements, superior in many respects to the asphalt pavements of twenty years ago, with possibly a few exceptions, which, by accident rather than by accurate technical knowledge, were successful, especially in such a case as the one mentioned in Omaha, where Mr. John Grant, from personal experience, laid a good pavement.

It was by analysis and tests of pieces taken from just such pavements that practical engineers learned how to repeat them in other parts of the country.

One reason why the asphalt pavement of earlier days succeeded in many cases, although the surface mixture was not the best, was because of the old-fashioned cushion coat which was between the wearing surface and the concrete below. This cushion coat was rich in bitumen and dense. It was, therefore, waterproof and prevented moisture from working up through the concrete foundation into the asphalt pavement wearing surface and thus softening this surface from below.

The almost universal use of the open or loose binder coat (mass of crushed stone and a little bitumen of asphalt cement) has been the cause, for many years, of the failure of many miles of street asphalt pavement surface, because moisture from the concrete as well as from the cracks next to the rails, manholes and in the surface, percolates in every direction throughout the binder and under the wearing surface. This causes decay of the surface, especially when an asphalt is used which is seriously affected by water.

Another fault of the open or loose binder is that, during hot weather, when the asphalt pavement is soft, it is forced down irregularly into the spaces between the stones of the binder. I know the binder was alleged to be used to prevent slipping of the surface, but it was and is used to even up the surface of the rough concrete foundations and to save about one-half the asphaltic cement which was needed in laying the old cushion coats.

No binder courses are used in Europe. The concrete base is finished with a uniform, firm mixture. The asphalt pavement wearing surface is laid directly upon this, although not of the same mixtures or materials as we generally use in the United States. If binder is continued to be used, it should be dense and made of graded, crushed stone of very small sizes combined with sand and stone dust, all mixed with about double the amount of asphaltic cement that has been used in the open or loose binder.

J. W. HOWARD, C. E., New York City.

Wide Tires Are Economical Road Improvers.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Mr. W. W. Finley, president of the Southern Railway, is quoted in MUNICIPAL ENGINEERING as saying among other things well said: "The condition of the road controls the size of the load. . . . The cost of hauling over poor roads is not appreciated. . . . The United States Agricultural Department has investigated the matter. . . ."

Here is substantially the Road Office report on what is by far the more important feature of the matter:

"Width of wheel-tire is found to have no effect on the traction on hard roads, but it has a very decided effect on the condition of the road surface and on the cost of maintenance." (Bulletin 20, O. R. I., 1896.)

"From my observations while at the Rock Island Arsenal, I am inclined to think that there is no particular advantage, so far as traction power is concerned, by the use of wide tires. Their improvement of the roads, however, is such a material advantage that we should do everything in our power to bring about the general use of such tires. Wide tires have the same effect as rolling, while narrow tires have the opposite effect, and destroy rather than improve the road. Narrow tires are destructive to hard roads as well as earth roads." (Letters from "Acting Director, O. R. I.," M. O. Eldridge, 1903-4.)

My witness, Mr. Finley, says: "Bad road condition increases the pull, reduces the haulable load; good condition, contrarywise." Road Office officials say: "Very decided bad chronic condition produced by narrow tires does not reduce load; very decided wide tire good condition, by comparison, would not reduce pull."

They are right, but what controls the conditions? Verily, the narrow tire, the bull in the china shop, dominates the situation, and all because a fool superstition as to "friction" possesses the people. Friction, draft, pull, frictional resistance, is made up of two kinds of elements of friction. One is due to the yielding, failing, depression of the road surface, different for different surfaces under a given pressure. The other is due to the wheel-tire pressure (per square inch) and differs on a given surface with width (and diameter) of the tire. We may elect to improve (reduce) the depression friction by road surface improvement, or we may elect to improve the pressure and its friction by widening tires, the size of wheels being subject to very little enlargement.

Now, seeing that so very much has been said and written about good roads, and pretty much nothing about good wheels, you might very naturally conclude therefrom that road improvement is vastly the more important of the two. But you could not make a bigger mistake, because

First—Nature has imposed this condition: The more you improve your road the more you reduce the depression caused by a given pressure, the more you increase the tire pressure and its tendency to cause destruction. Therein we may see the ugly look on the face of the road problem of how to make the improvement and its saving less its cost keep ahead of the destruction of vehicles and roads due to the increased pressure. True enough, the pressure is increased inversely with the square root of the depth of the depression, but who can say how much the cost per mile reduces this net friction gain?

Second—Contrarywise nature vouchsafes this provision: The more we improve (widen) the wheel tires and so reduce the pressure on a given surface, the more do we lessen the yielding of road surfaces. The depth of cut, or track, is lessened square times as fast as the pressure is.

In other words, my penny wisdom in refraining from venturing on good roads such as would lessen the depth of surface displacement, say three-fourths or 75 per cent; my abstaining from coming across with about 300,000 pennies per mile of road, leaves me pound foolish to the somewhat ugly tune of 300 per cent extra depth of displacement or destruction and its extra depth-pull, but to the more cheerful tune of 50 per cent less pressure gravity at that depth.

On the contrary, quite the reverse, the pound foolishness of refraining from good wheels—the utter rejection of 6-inch tires for 1½-inch—leaves us at the mercy of say 300 per cent extra depth of cutting and rutting, aggravated by 100 per cent added to the pressure gravity at that depth.

Depth of yielding lessened by road improvement means greater pressure; depth of yielding reduced by wheel improvement means as much less pressure.

Third—These facts are confirmed and rendered into pull by actual tests. The Missouri Experiment Station noted the depths of cut on soft ground in fourteen trials.

Average depths: 6-inch, 100 per cent; 1½-inch, 350 per cent.
The corresponding
Average pulls: 6-inch, 100 per cent; 1½-inch, 350 per cent.
Only 14 records were taken, but
36 runs made: 6-inch, 100 per cent; 1½-inch, 170 per cent.

The pulls varied from 127 per cent to 220 per cent for the 1½-inch tires.

Fourth—These facts confirm and are confirmed by a test consisting of six trials of 6-inch and 1½-inch tires on macadam and earth roads made by the Missouri Experiment Station, two August 28 and 29, two September 12, and two November 20, 1896. This is the only test on record which gives sufficient and reliable data for making a comparison between improved-road traction and improved-wheel traction. Being made altogether on roads in ordinary use (by narrow tires) the six trials are perfectly fair to the 1½-inch tires, but are not at all fair to the 6-inch tires. Here are the results:

	Pounds
Average pull of 1½-inch tires on 3 earth roads	86
Average pull of 1½-inch tires on 3 macadam roads	71
Average pull per ton saved by macadam	15

	Pounds.
Average pull of 1½-inch tires on 3 earth roads	86
Average pull of 6-inch tires on 3 macadam roads	61
Average pull per ton saved by 6-inch tires on earth	25
Average pull of 1½-inch tires on 3 macadam roads	71
Average pull of 6-inch tires on 3 macadam roads	55
Average pull per ton saved by 6-inch tires on macadam	16

My twenty-two years' close study of this matter of heavy-tire traffic, roads narrow-tire-bad as a matter of superstitious choice, assures me that the proper general tests would show about this:

	Pounds
Average pull of 1½-inch tires onearth roads, say	86
Average pull of 6-inch tires on earth roads	46
Difference in favor of wide tires	40
Average pull of 1½-inch tires on macadam roads, say	71
Average pull of 6-inch tires on macadam roads	31
Difference in favor of wide tires	40

However, let us see what the test, as it stands, shows in the case of the South. Outside of Kentucky, Tennessee and Maryland we have less than 2 per cent of our roads improved; with these included we have just 4 per cent improved. Say that 10 per cent of the traffic is over the improved roads; then here is the showing: For every 2,500 pounds that we could save with improved wheels, we now save only 150 pounds by means of improved roads. Besides, the cost of the 4 per cent of road mileage must be paid out of the saving to the 10 per cent of traffic and leave a good balance, else the value of affected property is not legitimately enhanced.

On the other hand, the saving to roads and vehicles (less any extra cost of the improved wheels) is to be added to the 1567 per cent saving in traction from improved wheels over and above that from improved roads.

Not only so. We could improve our roads with properly wide tires in general use, for about half what it now costs us to improve them, with narrow tires in general use (streets ditto) and would improve them four times as fast, and not get done any too soon at that. With 16 per cent of our roads improved, and say 25 per cent of our traffic over them, we could save as much more (150 pounds pull, less cost) as we now save by road improvement.

At a venture, I should say that wide tires in general use all along would have saved us at least 3,500 per cent more than our good roads have saved.

J. M. HEISKELL, Memphis, Tenn.

Cost of Operating Municipal Asphalt Repair Plant in Columbus, Ohio.

Mr. W. W. Horn, the efficient superintendent of the municipal asphalt plant operated by the city of Columbus, Ohio, under the Board of Public Service, Henry Maetzel, chief engineer, has just completed his report for the four months of the past year that the plant was in operation, and has kindly furnished MUNICIPAL ENGINEERING with the following data therefrom:

The plant does only patch or maintenance work, not being allowed under the present municipal code to compete with contractors on new work. Thirty-nine streets were patched, the pavements on which guarantees had expired being from twelve to twenty years old, and a few recently laid pavements being repaired where cut for water, gas, etc. The plant also laid 185 cubic yards of asphaltic concrete, where the cement concrete was worn away deeper than 3 inches. The cost of the work was $5.19 a cubic yard.

Teams cost 40 cents an hour and common labor cost 22.22 cents an hour. The totals for cost of 2-inch topping furnished by Mr. Horn are itemized as follows, giving the total amounts used for this work during the season:

3,165,650 lbs. of sand	$1,266.27
332,777 lbs. of asphalt	3,998.78
300,015 lbs. of limestone dust	420.12
64,224 lbs. of flux	816.81
9,583 lbs. of cement	29.70
284,106 lbs. of fuel	220.17
Labor	7,020.62
Miscellaneous items	944.77
Cost of 18,689 sq. yds. topping	$14,717.44

The weights include all shrinkage or loss, such as the cooperage on asphalt and the water in the sand, as lake sand was used, paid for by weight at the lake when loaded. The miscellaneous column includes the lubricating oil, coal oil, waste, dressing tools, superintending and keeping horse and buggy.

Nothing is said about repairs, but they were probably nothing at the plant, as it was entirely new, and were slight if anything for street roller and apparatus.

The sand apparently cost 80 cents a ton or say $1.20 a cubic yard; asphalt, $24 a ton; limestone dust, $2.80 a ton; flux, $25.50 a ton; cement, $1.20 a barrel; fuel, $1.55 a ton. The total cost per square yard was 78.75 cents. This figure includes nothing for interest on cost of plant or equipment, depreciation or sinking fund, or supervision beyond the salary of the superintendent of the plant for the four months the plant was in operation.

Waterproof Concrete and Waterproofing Concrete.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Regarding waterproofing with silicate of soda, asked about by R. F. R. in MUNICIPAL ENGINEERING, "Question Depart-

ment," vol. xxxv, p. 380, why not use a method and machinery that produce the real concrete block, impervious, one that shows by actual tests only about 3 or 4 per cent absorption?

The first requirement of such a machine is to obtain density. I reached this by grading my aggregate and then joining them together. First I tried a knuckle press, then a screw press strong enough to give 500 tons, but I did not obtain density because the aggregates, resting on top of each other, by a steady pressure would settle together, leaving voids between them, where aggregates of different sizes were used, and if the aggregate was finer and more uniform a steady pressure developed compression of air in the inner part of the block. The heavier the pressure the worse was the result, for when the pressure was released the compressed air would return to its natural pressure and by this action loosen the aggregates. Therefore a pounding pressure had to be provided, using a series of pumps of different sizes, causing the material to be pounded with blows of 200 tons each, which gives me maximum density. I then had to determine the amount of water to keep up the chemical action of the cement until the concrete was set sufficiently to allow water to be used on the surface without destroying its texture. To keep up the chemical action requires 10 per cent of water, for a less amount will be used up in the crystallization before the block is sufficiently cured, so the machine must be able to take a wet mixture.

To E. K. S., whose inquiry for a Southern city needing a block plant is on the same page in the December number, I would suggest Birmingham, Ala., as that city has not to my knowledge a good concrete block plant and is a growing city and a concrete block is in demand.

W. H. FISHER, Baltimore, Md.

A Concrete Bungalow.

To the Editor of MUNICIPAL ENGINEERING:

Sir: What is not only a novelty in concrete construction but also regarded by experts as a decided improvement and advancement over all other methods of concrete house-building is exemplified in the bungalow recently built by John F. Parker of 104 Congress street, Portland, Me., instructor in the Walker Manual Training School, for Miss Nellie G. Leach, who contemplated having a wooden bungalow built, but after Mr. Parker's scheme for cement and concrete construction was explained to her she decided to have him build a house his way.

The bungalow is 34 feet square and contains five rooms all on one floor. An ice chest is built into the house. The living room and dining room are separated by folding doors, which are capable of being lapped one part over another against either wall, thus converting the two rooms into one room 15 by 24 feet.

The exterior of the house is all of concrete panels, and save for the spaces about the windows and doors, is practically air tight. The concrete panels are but 1 inch in thickness and besides being remarkably light, are strong enough to bear an immense weight. The panels are reinforced with strips of steel wire, and in the tests applied to them they withstood the strain of three heavy men jumping up and down upon them and showed no sign of injury. They are ornamented on the outside with raised figures, scroll work, etc., from steel ceiling designs. There is no end to the decorative designs with which concrete panels may be embossed.

In the past year there have been built within a radius of ten miles of Boston about 100 cement houses, mostly of the bungalow type.

There are three principal methods of employing cement concrete in house building; cement plaster or stucco, applied on metal lathing over wood frames, hollow concrete blocks made by machine and used similarly to brick, and reinforced concrete, i. e., concrete made stronger by the incorporation of steel, in strips or otherwise.

Concrete houses have the following advantages over wood: They are fireproof, warm in winter, with consequent economy in fuel, cool in summer, are practically indestructible, need no repairs and need never be painted.

This house is built of cement concrete panels running the entire height of the building from foundation to roof. Each panel is 1 inch in thickness and 3 feet wide. Mr. Parker and his son made the panels in their own back yard and after being transported to the site of the bungalow they were all ready to be set up. The panels were molded in wooden frames on a base consisting of a strip of steel ceiling by means of which the decorative design was transferred to the cement, giving the panels an attractive appearance. The wooden frames were made of 3-inch stuff and the exterior of the concrete panel comes flush with the wood, while the recess in the side which forms the interior affords 2 inches of air space over the entire length and width of the panel, the cement concrete being 1 inch thick. This is accomplished by filling the forms partially with sawdust or other material before the cement concrete is poured in, then turning the form over so that the concrete can be pressed against the steel ceiling design of the mold. After sufficient water has been poured upon the composition to insure compactness and perfect settling in the mold, the sawdust filling is removed, the interior smoothed off nicely and the completed panel is left to dry and harden. Strips of steel wire are incorporated in the cement as it is laid in the mold, by way of reinforcement, but tests have shown that even this is not absolutely necessary, panels made without reinforcement having been sub-

jected to great strain without sign of weakness.

The panels securely fastened in the wooden frames are then ready to place in position. They are securely nailed to the sills over the foundation and fastened together at the top by double strips of 2-inch stuff which overlap each other at the corners. The wood partitions separating the panels are then covered with cement tenons which are mortised in such a manner as to form perfect joints. These cement tenons or joining pieces are made in molds as the panels and are 4 inches wide and the same length as the panels. Screws are set in the mold forms in the proper positions so that when the cement joining strips come out of the forms they are fitted with heavy screw holes coming just at the desired places, and by means of these it becomes easy to fasten them securely to the wooden uprights of the panel frames. Thus the entire exterior becomes concrete, and the connecting places between the panels are then sealed and the screw holes fitted with cement, making the structure practically air tight. The roof is built of wood in the ordinary way.

Another novelty of the building is the method and material employed for finishing the interior. On the inside the wooden frames holding the concrete protrude 2 inches from it. Over and upon these wooden uprights pulp board ¼ inch in thickness is spread and fastened. This pulp board is used as a substitute for plastering and is in every way superior. It can be paneled off in any design desired with strips of decorative molding, can be varnished, painted or surface-covered with paper veneer, which can be obtained in any number of designs and colors. The ceilings are of the same material and may be similarly treated. Thus it is seen that there is an air space of 2 inches between the exterior wall of concrete and the interior wall of pulp board. No cement is in the interior nor does it anywhere come into contact with the pulp board. A perfectly dry interior is thus assured. G. H. S., Portland, Me.

A REINFORCED CONCRETE BUNGALOW.

Newark City Council Could Not Grant Franchise.

The supreme court of New Jersey has rendered a decision holding invalid the ordinance passed by the common council of Newark granting a franchise to the Newark Block Lighting Company. The company had originally applied to the board of works for the franchise, but Joseph Coult, who was then city counsel, in an opinion held that the common council was the proper body to deal with the matter. His opinion was indorsed by the company's counsel and other lawyers. The supreme court holds the opposite view, however, and the only course for the Block Lighting Company to pursue is to appeal from that decision or else begin all over again its efforts to secure a franchise. It has announced its intention to appeal from the decision.

Mankato Can Build New Bridge.

The Minnesota supreme court handed down a decision November 27, sustaining Judge Cray in the suit of E. V. Watters vs. the city of Mankato, an action wherein Mr. Watters sought to permanently enjoin the city from proceeding with the construction of a second bridge across the river or from paying out or levying money for the purpose. Judge Cray decided in favor of the city and is sustained by the supreme court.

MUNICIPAL MATTERS IN COURT

Decisions of the Higher Courts on Questions of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Omaha Waterworks Franchise — Option of City to Purchase Plant—In 1880 the city of Omaha granted a franchise to a water company under Laws Neb. 1879, p. 99, sec. 27, which authorized the city to construct and maintain water works "either within or without the corporate limits of the city," and to contract with others to construct and maintain water works on such terms as might be agreed upon. In the ordinance granting the franchise the city reserved the right to purchase the works of the company after twenty years at an appraised valuation. By a subsequent statute, still in force in 1903, the city was authorized to appropriate private property for water works purposes, or any system already constructed, the power to extend a distance of ten miles beyond the city limits. Laws 1903, p. 66, c. 12, required the city to either construct or purchase water works and authorized it to take the necessary steps to acquire such water plant "by virtue of any rights inuring to such city through contract or otherwise."

In 1903 the city elected to purchase the company's plant under the option reserved in the ordinance of 1880, and appraisers were selected by the parties to make the valuation. When the works were constructed it was necessary to take the water from the Missouri River above the city, and the intake, pumping station and reservoirs were located in the town of Florence and some miles outside the city limits. The city had increased in population from 30,000 to 125,000. Adjoining and separate municipalities had grown up, into all of which, including the town of Florence, the company had extended its distribution system, which was supplied with water from its station at Florence.

Held, that under such statutes the city had power to acquire the property of the company outside as well as inside its limits, and that when it made its election, it elected to purchase the entire system, and could not require the company to sell its pumping plant and the pipes connected therewith, which extended into and lay within the city limits and to retain its outlying distribution systems. Omaha Water Co. v. City of Omaha, U. S. Circuit Court of Appeals (Neb., 1908).

Assessments — Recovery by Contractor.—Where a local improvement is provided for by ordinance, which expressly refers to the Local Improvement Act of 1897, the contractor (having agreed to take his pay in orders, three-fourths of which are payable out of the proceeds of the special assessment levied for such improvement) cannot recover for any portion of such improvement payable out of the special assessment until it is first shown to have been collected by the city. City of Momence v. R. Shannon & Co., 135 Ill. Appellate, 533.

Change of Grade of Street—Damages.—The legislature has power to compel compensation for damages resulting to abutting proper owners from changing the grade of a city street. Bernhard v. City of Rochester, New York Sup. Ct.

Change of Grade—City Not Liable.—A city is not liable for injuries to improved abutting property resulting from a change of grade in a street where no grade has been established prior to the improvement of the property, and the grade subsequently established is not unreasonable. City of Akron v. Huber, Ohio Sup. Ct.

Obstruction of Street by Improvement—Damages.—Occupation of a street by the construction of an improvement by a street railway 88 feet from the premises fronting thereon, diverting pedestrian travel on that side of the street in other directions, was an interference with the natural property rights of the owner. Fitzer v. St. Paul City Ry. Co. (Minn.), 117 N. W., 434.

Nuisance in Street—Abutting Owner—Unless an abutting owner owns the fee to the middle of the street he cannot maintain a suit to enjoin a nuisance in the street which injures him only in rights enjoyed by him as one of the public. The attorney-general in such case representing the public must file an information, and this though the abutting owner would be much more inconvenienced by the nuisance than others. St. Columba's Church v. North Jersey St. Ry. Co., New Jersey Court of Chancery.

Plank Walk—Duty of City.—A municipality is bound to know that a particular walk within its territorial limits is constructed of lumber and that the material of which it is constructed is likely to become decayed, and having such knowledge it is burdened with the duty of exercising reasonable care by inspection to see that the sidewalk is in a reasonably safe condition for travel. Wallace v. City of Farmington (Ill.), 83 N. E., 180.

Defective Sidewalk in Village.—The

rights of a pedestrian, injured because of a defective sidewalk, while the municipality owning it was a village, and the rights of the municipality, which subsequently incorporated as a city, must be determined under the provisions of the village law in force prior to the incorporation as a city. Romanowski v. City of Tonawanda, 112 N. Y. Sup., 105.

Pumping Plant—City Liable for Nuisance.—A municipal corporation which erects a pumping plant is liable for injuries to adjoining residence property caused by the emission of smoke, and it cannot avoid liability as for a nuisance on the ground that in maintaining the pumping plant it is exercising a governmental function delegated to it by the State. Gordon v. Village of Silver Creek, 112 N. Y. S., 54.

Sewer—Second Contract to Construct.—Where a city contracted with one to construct a sewer at a certain price, but the contract was thereafter declared abandoned by the city under a statute authorizing such action, and it thereafter contracted with relator to complete the sewer, the second contract was entirely independent of the first, references therein to the old contract being merely to describe and measure the work contracted for; and hence the two contracts cannot be connected so as to exempt the latter from the operation of a statute enacted after the first contract was executed. People v. Metz, Ct. of Appeals N. Y., Oct. 13, 1908.

Contracts—Sidewalk.—Compensation for the laying of a sidewalk cannot be recovered where the contractor laying the same knew at the time he did so that he was laying a sidewalk above the established grade of the city in which such sidewalk was laid. Tananevicz v. Lamezyk, 134 Ill. App., 135.

Sewer—Objection—Waiver to Defects.—Where a property owner appeared before the city council in local assessment proceedings and made objections to the proposed sewer, he thereby waived defects or irregularities in the notice of intention to construct the sewer. Andre v. City of Burlington, (Iowa) 1082.

Street Frontage Assessment. — The basis of the assessment for a street improvement is to be the proportionate benefit to the abutting lots, though, in the absence of any other consideration, the frontage may be considered as a basis. Des Moines Union Ry. Co. v. City of Des Moines, (Iowa) 293.

Town Repairing Sidewalk—Injunction.—Complainant held entitled to an injunction restraining a town's interference with his sidewalk until all legal prerequisites to a notice to compel complainant to rebuild his walk had been complied with by the town. Converse v. Inc. Town of Deep River, (Iowa) 1078.

HIGHWAYS

New York Highway Construction—New York Good Roads—Asphalt Rubber Pavements—Grade Crossing Refused

Highway Construction in New York State.

In the new publication of the Engineering Societies of Pennsylvania State College, entitled *The Engineer*, J. C. Gotwals, assistant engineer, Department of State Engineer and Surveyor, gives an account of the work in improving the New York State roads, from which the following is taken:

New York has given State aid toward the improvement of public highways since 1898. Under the operation of the law of 1898 relating to highway improvement, the State, county and township respectively pay 50, 35 and 15 per cent of the cost of the improvement. Since 1898, nearly 2,000 miles of roads have been improved. This work has been done under the supervision of the State engineer. The road improvement of the future as well as the maintenance of all roads is to be placed in the hands of a highway commission. The law creating this commission takes effect on January 10, 1909. In view of this change in administration, it is of more than passing interest to learn of the methods and results obtained in the past eleven years in improving roads in the Empire State.

The initial step, leading to the improvement of any road, must be taken by the Board of Supervisors of the county in which the road lies. This board sends a petition to the State engineer for the improvement of the road. The petition received, the State engineer sends a survey party to get data for the plans and estimates of cost of the road.

The methods used in surveying a road to be improved are now fairly uniform through the State. While occasionally conditions call for a special survey, the method in common use is substantially as described here. A survey party usually

consists of six men. A so-called "base line" is run along the road. This line consists of a series of "tangents," placed in the probable location of the center line of the improved road. The points of intersection of these "tangents" are tied in by three or more measurements to surrounding objects, and the angles between the "tangents" are measured by an azimuth traverse run along the line. Distances are measured along this "base line" and, starting from an arbitrary zero, objects are located by the customary station and plus along and offset from this line. Fence lines, tree lines, property lines, houses, as well as any features that may have a bearing on the plans for the road, are located in reference to this line. This is the work of the transit party.

The level party establishes bench marks, takes cross sections and gets data for the profile of the road. Cross sections are taken at least every 100 feet, and oftener if necessary. The "base line" is used as a center line of these sections. In taking sections, the location of rock ledges must be noted. Sometimes, where a very deep cut will be necessary in improving a road, the rock ledge is located by drilling. The profile of the drainage ditch of each culvert is obtained. Bench marks are left at least every 1,000 feet along the road. The man in charge of the survey, besides assisting in the above work, looks up special points bearing on the improvement of the road; the location and condition of all existing culverts are carefully noted. Sometimes an old culvert can be retained in the new road. The location and nature of all unstable material in the road, as well as the apparent way to carry the road past the material, are investigated. The proximity of the road to railroads and water is also recorded. Frequently the alinement, or grades, or both, of the old road, are such that an entirely new line across private property must be surveyed. This is called "side line" work, and the line begins and ends at points on the "base line." In "side line" work, curves are laid out. Property lines must be located with considerable care on "side line" work. The surveys are run fairly rapidly. Parties of six men usually run a mile of survey per day on the roughest work. This rate of speed is doubled in easy level country.

The quality of the available stone for macadam purposes is investigated by the men of the New York Stone Testing Laboratory. This laboratory is a recent innovation in the State engineer's department. The equipment of this laboratory is a duplicate of the equipment of the Road Materials Laboratory in the Bureau of Good Roads, United States Department of Agriculture, Washington, D. C. Space forbids the giving of a detailed description of the equipment of this laboratory. Those interested will find a description of the laboratory in Washington, D. C., just mentioned, in Bulletin No. 79, United States Department of Agriculture. In New York, a man from the laboratory is sent to get samples of stone available for the improvement of the roads. These samples are tested, and the tests give the hardness, toughness, percentage of wear, absorption and cementing value of the stone, a card being prepared for each sample. On one side of this card is recorded the name of the road on which the stone is used, the geologic and petrographic classification of the sample, as well as the result of the tests. On the reverse side of this card a small map of the road and its vicinity is pasted with the location of the rock ledge from which the sample was taken marked thereon. The maps issued by the United States Geological Survey are used for this purpose. Thus the nature of the rock is definitely recorded. After use on the road, and thus having the laboratory conclusions checked, the information in regard to these rock samples bids fair to become of great value both in New York and elsewhere.

After the survey has been made and other special features have been noted, the plans for the road improvement must be drawn up and an estimate made on the cost of the work. The plotting of the surveyed "base line" with the information relating thereto and the profile and cross-sections constitute the first step in the drafting room.

A trial center line of the new road is then sketched in. This center line does not necessarily coincide with the surveyed "base line." Curves are shown on this paper location of the center line. A trial grade line is also established on the profile. The maximum grade used on improved highways varies from 6 to 8 per cent, depending on the importance of the road. Level grades are avoided and frequent changes of grade are made. Parabolic vertical curves are computed at all changes of grade. The width of roadway, and of surfacing as well as the shape of road, is decided on. Using the standard section called for by the width and shape, the work to be done in building the road to conform with the trial center line and grade line is completed. This is done by plotting on each cross section the cross section of the new road at the proper elevation. Using a planimeter to measure the areas in cut and fill, the quantities in excavation and embankment are computed. The attempt is made to establish the grade line so that the material from the excavations will form the embankments with the added provision that the haul from cut into fill must not exceed 2,000 feet. To so establish this grade line, calls for considerable shifting before a final location is decided upon. Experienced men at this work can plot a grade line at the first trial that calls for very little change. Very long fills are often made, in which case material is paid for

as borrow, embankment in place, or excavation with overhaul. A uniform factor of shrinkage for material taken from cut into fill was formerly allowed for all roads; now the shrinkage factor to be used is chosen by the resident engineer and depends on his knowledge of the previous use of the same material. After the grade line and center line are established, culverts must be planned and estimated for. Macadam rolled in place, paving, rip-rap, masonry and retaining wall, ditch crossings, sub-base course, guard rail, etc., must be estimated as exactly as the information at hand allows. Having all these conditions, prices are assumed for the units of each item in the estimate and the cost of construction computed. The data of the cost of road construction are compiled by the deputy State engineer. Men in charge of construction send weekly report of labor and equipment expense, as well as progress made on each road under construction. These reports serve as a basis for the prices used in estimating the cost of proposed work. The State engineer next submits the plans and estimate of construction cost to the local Board of Supervisors for approval.

A number is given to each road as soon as its plans are approved by the supervisors. The contracts for roads are let in the order of their number. Bids are advertised for and contracts let in the usual manner. Previous to 1907 bids were made in a lump sum for the performance of the work, but since then bids have been made by items. The latter method increases the engineering work to a considerable extent, but is otherwise more satisfactory.

The engineering organization dealing with the planning and supervision of construction of these improved roads is no small one. For this purpose the State is separated into three divisions — eastern, middle and western. A division engineer has charge of both the highway and canal work in each division. Each division for purposes of highway improvement is cut up into residencies, each in charge of a resident engineer. Each county is in charge of an assistant engineer. Roads under construction have a man placed in responsible local charge of the work. The plans are drawn up in the office of the resident engineer, who is given a quota of assistant engineers, levelers, rodmen, draftsmen, highway inspectors, chainmen, and axemen, whom he assigns to survey work, office work or construction work as the calls of duty demand. The resident engineer takes up important matters with the division engineer, who in turn refers matters of great importance to the State engineer.

The contracts for roads are usually made of such length that one contracting plant, if managed efficiently, can complete the work in one working season. The best length of road to let in a single contract is found to be about six miles, but a few rounds as long as ten miles have been let. Such a length of road as this is likely to stretch over several seasons before it is completed. Roads as short as one mile are built, but their unit costs are usually excessive, due to the small amount of the work.

The resident engineer of the residency in which the road lies sends a man with several assistants to take charge of each road as soon as the contractor is ready to begin work. The engineer in charge is furnished with the plans and specifications of the road as well as with the equipment necessary in laying out the work. His first work is to run the old survey and check out the distances. He then lays out the new center line and takes a new set of cross sections referred to this new center line. This work is done just preliminary to construction. The contractor must be given line and grade of the road from time to time. To do this, stakes are set along the edge of the road, so that they will not be disturbed. On these stakes the offset to the center line of the road and the cut or fill to the crown of the road are marked. These stakes are set at least every 100 feet on "tangents," and oftener on curves. In very heavy work slope stakes are set, but ordinarily the foremen are allowed to run the slopes out. Culverts must be laid out from time to time. All of the structures incident to the work are indicated by the engineer as the work progresses. The materials used must be inspected and the workmanship supervised to see that the specifications are conformed with. The amount of engineering supervision required depends on the character and experience of the contractor and his foremen. At the close of each month the contractor is paid for the work done up to date. This work is estimated as it is actually done, and not necessarily as the original quantities called for. When the work is completed the engineer in charge must make out a final estimate on the work. All structures are estimated and paid for just as they are in place. To get the volumes of excavation and embankment the entire road must be re-cross-sectioned. These sections used with those taken on the unimproved road give the quantities of excavation and embankment. The exact location of both rock and earth must be indicated on the final sections. The areas of the sections in cut and fill must be computed, and not measured with the planimeter in making the final estimate of quantities. With the completion of the final estimate, the engineer in charge closes his connection with the road.

What has preceded in this description holds for all improved roads in New York. A few roads are built in which shale or gravel is used for surfacing. As these roads are but a small percentage of the whole number of roads improved, they will be dropped from this discussion.

Macadam surfacing is the rule, and being such, the remaining space is devoted solely to roads of this class.

The process of macadamizing is of prime interest in construction. The road bed is first brought to the proper shape and elevation. The material in the sub-grade is thoroughly consolidated with the 10-ton steam roller. Sometimes unstable material is met with in the sub-grade. In such case, a sub-base course is provided. A layer of gravel, quarry spalls, tailings from the crusher or Telford base is used. Telford base, which consists of large quarry or wall stones laid by hand and wedged tightly together, is the most common remedy for a bad sub-grade. The depth of sub-base course used varies from 6 inches to 2 feet. Tile drains, formerly used exclusively to render an unstable sub-grade firm, have been largely abandoned. The two-course road is the favorite one. Crusher product is screened into four sizes as follows: Screenings up to ½ inch in diameter; maintenance stone between ½ and 1¼ inches in diameter; top course stone between 1¼ and 2¼ inches in diameter; bottom course stone between 2¼ and 3½ inches in diameter. On the prepared sub-grade the bottom course stone is spread to the required thickness. This is then thoroughly rolled. A filler of sand or screenings is then applied to this course and is thoroughly broomed in to fill the voids. The roller is again run over this course. Next the top course is spread and rolled. Screenings are then broomed over the surface of the stone. Rolling again follows. Next, the surface is thoroughly wet with water from a sprinkler and again rolled. The first puddling is then over. Soft limestone will often make up firm, hard macadam in one one puddling and rolling. Most stone, however, requires continued rolling and puddling from day to day until firm, well-bound macadam is obtained.

The two courses are each required to be 3 inches in depth, rolled in place. To obtain this result the loose stone is laid 4 inches in depth in each course. Cubical blocks 4 inches on a side are used in gauging the depth of loose stone. Numerous variations exist in the general method just described. Often a top course of trap rock is used and a bottom course of sandstone or limestone. Sometimes a 6-inch bottom course is used. The width of macadam used varies from 12 to 22 feet. A relatively great crown is favored in New York. For a 14-foot width of macadam a 6-inch crown is common. Limestone screenings are often used as a binder in a road built of hard stone such as trap. The above method of laying macadam is a general average of the method in use.

The resisting power of macadam laid as above described to the action of automobiles has been severely tested recently. During the long stretch of dry weather in the summer of 1908, the macadam roads of New York were subjected to the severest kind of motor-driven traffic. From this experience it is generally concluded that some binder other than screenings must be used on the surface of macadam roads. Coal tar preparations, as well as raw petroleum, are among the materials frequently tried as a binder and dust preventive in New York. This matter is here, as elsewhere, in the experimental stage.

The amount of material moved on these roads varies from 3,000 to 5,000 cubic yards per mile of road. The nature of the work is such that very rarely can any other method than pick and shovel work be economically used. Drag and wheel scrapers are occasionally used, and steam shovels more rarely. The deep ditches formerly used on State roads have been abandoned. Shallow ditches are now the rule. The cost of excavation per unit of material moved seems excessive to a railroad engineer. However, in consideration of the great amount of trimming of slopes and bermes required per unit of material moved, the cost seems reasonable. The factor of shrinkage to be allowed in estimating the excavation to make an embankment is now given considerable thought. This factor is a matter of judgment and varies greatly on different roads.

In taking care of the surface water, both from the road and adjacent territory, masonry culverts are provided. Concrete is now almost exclusively use in these culverts, which are built up to a 30-foot span. The paving and side walls in these culverts are built of 1:3:6 Portland cement concrete. The slab spanning the opening is built of 1:2½:5 Portland cement concrete. Up to a span of 3 feet expanded metal is used as reinforcement in the slab; from 4 to 10 feet in span, deformed bars of steel are used for reinforcement. Spans greater than 10 feet are crossed with I-beams surmounted with a slab of concrete, reinforced with expanded metal. Standard plans are provided for all culverts, but the engineer in charge often makes many changes better to fit conditions. These culverts, properly built, are permanent, substantial structures.

Special construction is often called for in improving roads. Every variety of clay and quicksand is met with. In the earlier work, economy forced many engineers to meet the conditions due to these materials in the quickest and cheapest manner. As a result, many cuts made in dry weather through clay were clogged by sliding banks in the spring break-up. The knowledge has come, here as elsewhere, that good engineering is also substantial engineering, and substantial engineering means liberal first cost. The clays of New York are a continuous source of trouble to highway engineers. Many other unforeseen difficulties arise on this work that must be met with the materials and men available.

The ditches on grades exceeding 5 per cent are paved to prevent wash. Retain-

ing walls of concrete and stone masonry are used to hold unstable banks in position. Paved slopes and rip-rap are sometimes used instead of retaining walls. Roads built adjacent to streams of water have the slopes that are exposed to the stream's wash rip-rapped. Guard rail painted white is liberally used along these roads. Approaches to property adjacent to the road must be graded. Stone is left piled along the road for use in maintaining and repairing the road.

These roads represent an outlay of about $10,000 per mile. No adequate provision has been made to maintain properly in good condition this extensive investment. The neglect of these roads in the past has done great damage. Added to this damage we have the destructive automobile. Excellent roads have been stripped clean of binder by autos. As a result, the stones ravel out and the macadam surface is gone. What treatment can be applied to the macadam surface at a reasonable cost and thus overcome the action of motor-driven traffic is not at present definitely known.

In building roads in New York many varied conditions are met. Roads are built on the sandy level stretches of Long Island where little grading is necessary, but stone must be brought in at great cost. In the highlands of the Hudson Valley, in the Catskills, in the Adirondacks, the roughest work imaginable was encountered. Again, in the comparatively level farming country of central and western New York still other conditions are met. Roads are built costing as low as $3,000 per mile and as high as $25,000 per mile. For macadam surfacing, the material ranges from the toughest trap rock to soft limestone and sandstone. The work of the road builder in New York has not been perfect. Yet his work is a long step forward toward the time when the highways of America shall be better than trails.

New York in the Lead in Good Roads Construction.

A statement issued by Frederick Skene, State engineer of New York, December 12, shows that 820 miles of good roads have been constructed in that State during the present year. During 1907 311 miles were constructed. He says:

There are at the present time approximately 500 miles under contract and over 1,000 miles awaiting contract. Of the $50,000,000 State money voted by the people for this work, $11,000,000 has been appropriated by the Legislature. If the roads completed during the last season were placed end to end, they would reach from New York City to Buffalo, via Albany and Rochester, and from Buffalo to New York City via Elmira and Binghamton.

Mr. Skene points out that Massachusetts and New Jersey formerly took the lead in good roads work, but that New York is now far in advance of these States in the improvement of its highways. According to a comparative table included in Mr. Skene's statement, from January 1, 1905, to January 1, 1906, New Jersey constructed 451 miles, Massachusetts 287 miles, and New York 792 miles of good roads.

Asphalt Rubber Pavements in France.

According to a report from Consul General Robert P. Skinner, experiments made with rubber asphalt pavements in several cities of France, including Paris and Lyons, have given good results. A satisfactory experiment was made several years ago upon the Prado, in the city of Marseilles, and this year three or four public places, devoted exclusively, however, to pedestrian travel, have been similarly paved.

Railway Protests Against New Highway Crossing at Grade.

The State Railroad Commission of New Jersey has refused permission for the establishment of a grade crossing at Keyport, Monmouth county, New Jersey. Inasmuch as it was the railroad that objected to the grade crossing, the case in which the decision was rendered is a rather unusual one, for it is the ordinary thing for the railroads to apply for the privilege of establishing such crossings. When they have been denied the privilege, in the past, the companies have set up the claim that they were being unjustly treated. Wishing to open a street across the tracks of the Central Railroad of New Jersey for the benefit of the proprietors and employes of a sawmill, the town officials of the municipality of Keyport applied for the crossing. The railroad people objected on the ground that the crossing at grade was not a necessity, as there were already two crossings within 600 feet of the place. The State Railroad Commission sustained the position of the railroad. In an opinion by Commissioner Whiting, the chief reason for deciding against the grade crossing was that it would have been, if established, a death-trap, and, therefore, public welfare demanded that it be refused. Instead of increasing the number of such danger spots, the policy of the State must be to gradually eliminate those already in existence. He says:

The proposition to increase their number in a thickly populated State which has more miles of railway per 100 square miles than any other State in the Union, cannot be entertained. The time has come now, if it had not arrived long since, to forbid the opening of such crossings in New Jersey except in certain rare instances where there is some controlling reason to prevent the construction of a crossing other than at grade. A future generation would justly condemn a public sentiment of today which would tolerate a contrary view.

STREAM POLLUTION

Pollution of Potomac—Pollution of Croton Water—Sewage Farms for New York—Washington Aqueduct

Power of Government to Prevent Pollution of Potomac River.

In the opinion of General Davis, judge advocate of the army, the courts of the United States may be invoked by the general government for the discontinuance or abatement of any nuisance which may be found to exist due to the pollution of the water of the Potomac river. The opinion is approved by Secretary Wright.

The question was brought up by Major Spencer Crosby, Corps of Engineers, in charge of the District water supply system, who inquired regarding "what proceedings, if any, can be taken, under section 1806, Revised Statutes, to prevent persons, communities, corporations, etc., from polluting the waters of the Potomac river above the intake of the Washington aqueduct at Great Falls, Maryland." He stated that while there are but few towns on the Potomac watershed above Great Falls at the present time that are sewered, it is considered important that no material increase in such pollution be allowed.

The laws bearing on the subject were review by Judge Advocate General Davis, who concluded as follows:

Although, in the case of the Washington aqueduct, two States of the Union are not parties to the action, it will not be denied that two sovereign States—the United States and the State of Maryland representing one of its incorporated instrumentalities—do stand in the relation of parties in respect to this matter; the United States acting as the sovereign of the District of Columbia in virtue of the grant of power in the Constitution, which vests in Congress authority "to exercise exclusive legislation in all cases whtasoever over such District (not exceeding ten miles square), as may, by cession of particular States, and the acceptance of Congress, become the seat of the government of the United States."

It has been seen that the Washington aqueduct is an instrumentality, not of the District of Columbia as a political entity, but of the government of the United States, which is necessary to the existence and operation of the general government in the place set apart for its exercise of governmental functions in the federal District; and that, upon a proper showing, such extraordinary remedies as the circumstances seem to demand may be applied by the proper courts of the United States, on the application of the general government, and with a view to the discontinuance or abatement of conditions which are calculated to render the water supply of the governmental agencies established in the District of Columbia impure or otherwise unfit for the use for which, in pursuance of appropriate acts of Congress, it has been introduced into the said Federal District.

It is conceded that no present necessity exists for the application of an extraordinary remedy to the existing conditions in the upper waters of the Potomac river. When those conditions become such, however, as to constitute a menace to the operation of the aqueduct, it is the view of this office that an appropriate remedy may be invoked in its behalf with a view to the discontinuance or abatement of any nuisance which may be found to exist due to the pollution of the waters of the Potomac river.

It is, therefore, the opinion of this office that section 1806, Revised Statutes, does not provide a remedy for the contamination of the waters of the Potomac river by sewer systems and other sources of pollution installed by municipal corporations and incorporated towns upon the upper waters of that river. It is also the opinion of this office that the proper remedy for that state of affairs, when it is found to exist, is by writ of injunction.

The form of remedy, however, will depend to some degree upon the extent of the pollution and its source. So soon as those incidents can be reasonably determined, and having regard to the extensive powers which are vested in the Congress in respect to the government of the District of Columbia, it is suggested that the matter be brought to the attention of the legislative department of the government, with a view to the application of such a remedy as may be demanded by the conditions of pollution which may be found to exist.

Secretary Wright forwarded the opinion of the judge advocate general to Chief of Engineers Marshall, expressing his concurrence in the views expressed by the law officer of the army. That opinion will hereafter govern the action of the engineer officer in charge of the District water supply system in all cases of pollution of the Potomac river above Great Falls.

Greater Power Over Preservation of Purity of Croton Water Desired.

The Charter Revision Commission of New York is being urged by John H. O'Brien, commissioner of the department of water supply, gas and electricity, New York City, and I. M. De Varona, chief engineer, to empower the city fully to protect the Croton watershed from pollution. They furnish statistics to show that, five years ago, there were cases of nuisance on their books which are still unabated. Under the present acts of the legislature the boards of health of this city and the small communities in the watershed are powerless to punish those

who refused to obey the orders of the authorities. No nuisances were abated under compulsion. Unless the person served is public-spirited enough to act on his own free will, notices to abate are not heeded. Commissioner O'Brien will appeal to the legislature, as soon as it meets, to give the city direct control of the watershed. The present situation is so grave that it has been determined to leave nothing undone to obtain relief.

Between Mount Kisco and Bedford Village the overflow from a large country home is said to run into Broad Brook, a feeder of the Croton. An inspector reported this matter last June, and a copy of the report was sent to Dr. Eugene H. Porter, president of the State Board of Health. He sent word that he had no power to act, and advised Commissioner O'Brien to go ahead. The property owner said he would build a sewer as soon as his home was unoccupied. He lived there in the summer only, and did not care to have the work done then. Owing to the great drought the nuisance became so serious that the inspector was instructed to let the department know when the house was vacated so that the owner could be urged to act at the earliest possible time. The house was reported vacant about three months ago, but no steps have been taken, apparently, to build the sewer, nor has the owner of the place answered the urgent appeals of the department.

Every means possible will be exhausted now to compel obedience to the order of the department without recourse to the courts under the present laws. The State Board of Health thinks the water department should take the initiative in having the law changed so as to make it effective.

Sewage Farms on Long Island for New York City.

A big sewage farm, utilizing a tract of 100,000 acres of the sandy wastes of Long Island, is proposed. A series of farms for the treatment of sewage from Greater New York by the irrigation process is involved in the scheme, and the plan suggested provides for piping the sewage of the Metropolitan district in two main lines, running probably from the Wallabout and Coney Island districts.

Capacity of the Washington Aqueduct.

In a brief report submitted to General Marshall, chief of engineers, War Department, Major Crosby, engineer officer in charge, shows that the limiting capacity of the District water supply system is about 90,000,000 gallons a day. He observed "that this indicates that the city is nearer the limiting quantity than has been supposed. Until the rendering of this report it had been generally supposed that the capacity was at least 95,000,000 gallons a day. His report regarding the recent operations of his office in the investigations and surveys for an increased water supply for the District would indicate that all the field work has been completed, including Rock creek survey, and that with the exception of the latter, the work of plotting the field notes is completed. Progress is being made on the studies for designs and estimates. Considerable time was devoted to a study of the hydraulics of the old aqueduct system, including a review of all old studies, and an actual test was made to determine the accuracy of the results obtained. The important indication of the study, however, was that the capacity of the system is about 90,000,000 gallons instead of 95,000,000 gallons or more per day.

MUNICIPAL AND TECHNICAL LITERATURE

New Publications.

Public Water Supplies; requirements, resources and the construction of works. By F. E. Turneaure and H. L. Russell. With a chapter on pumping machinery by D. W. Mead. Second edition, revised and enlarged. Cloth, 808 pp., $5. John Wiley & Sons, New York City.

The first edition of this book was published in 1901 and a full review was given in MUNICIPAL ENGINEERING, vol. xxi, p. 6, in which the book is compared with the other books in the same field. It will be seen from that review that this book is the most complete and the most satisfactory of those named.

The present edition has been brought fully down to date, in part by rewriting and in part by the addition of 62 pages. This work of revision is done more carefully and thoroughly than usual and the increase in length of the lists of books and articles given at the end of each chapter shows that the authors have kept pace with the advancement of the last seven years. Practically every chapter has its additions. Among the more prom-

inent are the discussions of consumption and many data from recent observations; rainfall and flow of streams; flow of ground water; recent advances in bacteriology of water and interpretation of results; compound interest tables; percolation of water in earthen dams; buttressed dams; sedimentation and coagulation in purifying water; slow sand filtration improvements; rapid sand filtration, in mechanical filters; scrubbing, aeration and softening of water; the use of copper sulphate; association standards for water pipe; selection of boiler capacity; reinforced concrete dams, tanks and reservoir walls; covered reservoirs; statistics of special fire protection systems. This list indicates the lines of progress in the water works field and is valuable on this account. It covers the field so completely that it demonstrates the freshness and completeness of the book.

Highway Engineering. By Chas. E. Morrison, C. E. Cloth, 315 pp., $2.50. John Wiley & Sons, New York.

The author calls his book a text-book for sophomore college students, and it bears the marks of the instructor, inexperienced in the practical work in the field he tries to cover, who tries to make a book to fit the time his class can devote to the subject. The writer has felt the same desire to make his own text-books but successfully resisted it. The chapters show uneven quality, the author being better informed on the subjects of road resistances and earth, gravel and broken stone roads than upon pavements. The chapters upon stone, brick, asphalt and wooden block pavements are very unsatisfactory and are very brief when the New York City specifications are subtracted from them. These documents are given in full, even including the sections common to all four in content if not in form. The subject of street design also has very inadequate treatment with occasional misstatements. One wonders where are located the business streets on which the distances between curbs vary from 80 to 140 feet and are seldom exceeded. Lucky is the city which has even one such street, and defective would be the reasoning of any city official who would construct many such roadways in any city of ordinary size and amount of traffic. The tendency is toward reducing the roadways where traffic will permit, the street area being thrown into sidewalks and lawns, both to save expense and to improve the appearance of the city. Cities like New York require special treatment, but they do not have the wide streets spoken of.

The earlier chapters give the New Jersey road specifications in full, even to the certificates and blanks for signatures at the ends, giving the appearance of padding. In the college work the preparation of specifications is rather in the nature of laboratory work, and a text-book can hardly give more than indications of their forms and varieties of content, the student being really best treated when he is given the conditions of a problem and is required to work out the details from study and comparison of the many forms of specifications which should be on file in the department library.

The practicing engineer will hardly be satisfied with this book and would ordinarily get better service by doubling his investment and purchasing one of the larger books, such as Baker, Byrne or Tillson.

The Architect's and Builder's Pocket Book. A handbook for architects, structual engineers, builders and draughtsmen. By Frank E. Kidder, C. E., Ph. D. Cloth, 1,661 pp., 1,000 illustrations. John Wiley & Sons, New York.

Quite a full review of the fourteenth edition of this book was given in MUNICIPAL ENGINEERING, vol. xxviii, p. 462, much of which was devoted simply to a list of the subjects treated. It is only necessary to say that it contains practically everything in the shape of reference material that those engaged in structural work in any capacity are likely to need. The fact that some fifteen thousand copies have been sold in the past four years and thirty-five thousand in all is evidence that it contains what architects and engineers want in such a book.

The present edition is of the same size as the last preceding one, but chapter xxiii on fireproofing of buildings has been rearranged and rewritten and brought down to date, and chapter xxiv on reinforced concrete is new. Owing to the death of Mr. Kidder, these chapters have been prepared by Rudolph P. Miller, C.E., formerly chief engineer in the building department of New York City, and they present the main facts, theories, formulae and tables in concise and convenient form, being confined to architectural applications.

The book is one of the labor savers which every engineer's and architect's office needs.

Engineers' Descriptive Charts. By Joseph G. Branch. Steam engine, 50 cents; steam boiler, 50 cents; electric generator, 50 cents; fireman's chart, $1; chart book, $1. Rand, McNally & Co., Chicago, Ill.

The three charts first named contain several diagrams each, showing the steps in the development of the steam engine, the steam boiler and the electric generator, and a number of questions and answers based on the diagrams. The chart book contains all that is given in the charts with accompanying full explanatory text and 400 questions asked by examining boards of engineers and answers to the same. All are printed in three colors for clearness of definition, and are intended for engineers, firemen, electricians, machinists and students.

ORGANIZATIONS AND INDIVIDUALS

Indiana Engineering Society—National Association of Cement Users—Canadian Concrete Association—Chicago Cement Products Exhibition—Northwestern Cement Products Association—Technical Publicity Association—Technical Meetings—Civil Service Examinations—Personal Notes

Indiana Engineering Society.

The convention of the Indiana Engineering Society to be held in Indianapolis, January 14, 15 and 16 promises to be of more than usual interest. Among the papers to be presented are the following:

"Pollution Problem of Lower Lake Michigan," by Dr. H. E. Barnard, Indianapolis.

"Work of the Royal Commission in Sewage Disposal in England," by F. A. Barbour, Boston, Mass.

"Maintenance of Sewage Purification Works," by R. L. Sackett, Lafayette.

"Stream Pollution Legislation," by C. C. Brown, Indianapolis.

"Water Power of the St. Joe River," by A. J. Hammond, South Bend.

"The Manufacture of Portland Cement," by E. E. Fillion, Mitchell.

"Water Softening and Purification for Manufacturing and Domestic Purposes," by M. W. Mix, Mishawaka.

"Short Span Bridges," by A. R. Holliday, Indianapolis.

"Construction and Cost of Reinforced Concrete Floors," by W. K. Hatt, Lafayette.

"Reinforced Concrete Bridges," by D. B. Luten, Indianapolis.

"Method and Cost of Highway Construction in Indiana," by G. E. Martin, Lafayette.

"Tests of an Automobile," by L. V. Ludy, Lafayette.

"Supervision and Inspection of Railroad Crossings and Interlocking Plants," by H. O. Garman, Lafayette.

There will be the usual reports of committees on drainage, electric railroads, steam railroads, electricity, concrete in building, including a new reinforced concrete building ordinance for Indiana cities, materials of construction, mechanical engineering, central station light and power, roads and pavements, and mining.

There will be an excursion to the new Big Four shops at Beech Grove.

The Indiana Water Supply and Public Health Association will hold its second meeting the same week, and the members of that association as well as those of the Indianapolis Technical Club are invited to attend the Engineering Society's banquet on the 14th.

National Association of Cement Users.

The fifth annual convention of the National Association of Cement Users will be held in Cleveland, O., January 11 to 16. The sessions of the convention will be held at the Hotel Hollenden and the exhibits will be located in the Central Armory.

Among the papers to be presented are the following:

"Cost and Value of Concrete Roads," by J. H. Chubb, Chicago, Ill.

"Revision in Standard Specifications for Sidewalks" and "Proposed Standard Specifications for Concrete Roads," by the committee on streets, sidewalks and floors, W. W. Schouler, chairman, Newark, N. J.

"Cost of Reinforced Concrete Construction as Applied to Buildings," by Leonard C. Wason, Boston, Mass.

"Comparative Cost of Reinforced Concrete Buildings," by Emile G. Perrot, Philadelphia, Pa.

"The Availability of Concrete for Bridges, Its Cost and Durability," by H. H. Quimby, Philadelphia, Pa.

"Cost of Reinforced Concrete Construction as Applied to Bridges," by E. P. Goodrich, New York City.

"Decorative Concrete Stone," by F. A. Norris, Boston, Mass.

"Reinforced Concrete Residences," by B. A. Howes, Jr., New York City.

"Small Concrete Houses, Manufacture and Cost," by R. C. Knapp, Philadelphia, Pa.

"Monolithic Concrete Wall Buildings, Methods, Construction and Cost," by Robert H. Aiken, Chicago, Ill.

"Advantages of Reinforced Concrete for Railroad Construction," by B. H. Davis, Hoboken, N. J.

"Cold Storage Warehouses of Reinforced Concrete Construction," by J. P. H. Perry, New York City.

"The Applicability and Comparative Cost of Concrete and Reinforced Concrete for Subway Construction," by Charles M. Mills, Philadelphia, Pa.

"Value and Cost of Reinforced Concrete for Retaining Walls," by A. Lindau, St. Louis, Mo.

"Methods and Economy of Assembling Reinforcement as Units Before Placing in Reinforced Concrete Construction," by H. F. Porter, Philadelphia, Pa.

"Methods of Attaching Shafting and Machinery in Reinforced Concrete Buildings," by Wm. M. Bailey, Boston, Mass.

"Value and Cost of Steam Curing of Concrete Blocks," by F. S. Phipps, St. Joseph, Mo.

"The Present and Future of the Cement Block, Its Cost, Manufacture and Availability," by J. Augustine Smith, South Bend, Ind.

There will be the usual reports of committees, some ten in number, and there are several subjects named on the program for which speakers are not announced. Apparently there is some expectation that some of the speakers will fail to appear, or they are strictly limited to time, otherwise it will be physically impossible to crowd the program into the space provided for it.

Exhibits are classified and grouped as thoroughly as possible. All the space on the main floor of the exhibit hall has been taken and nearly all of that in the gallery has been applied for. Prizes are offered for the most attractive, effective and artistic arrangement of exhibits, $50, $25, $15 and $10 in amount.

It will require an attendance of 1,000 outside the city to secure the reduced rates of one and one-half fares for the round trip. The program should bring the required number if every one within reach who is interested in any one subject will come.

Canadian Cement and Concrete Association.

The first annual convention and exhibition of the Canadian Cement and Concrete Association will be held in the St. Lawrence Arena, Toronto, Ont., March 1 to 6. The president of the association is Peter Gillespie, lecturer on the theory of construction at the University of Toronto; the secretary is A. E. Uren, 62 Church street, Toronto; and R. M. Jaffray, 1 Wellington West, Toronto, is the manager of the exhibition. Plats of the exhibition space and full information concerning details can be obtained from the manager. The program of the convention will be announced later.

The Chicago Cement Products Exhibition.

The Chicago Cement Show of February 18 to 24 in the Coliseum is already an assured success, the number of prospective exhibitors being so great that a supplementary circular has been sent out with a plat of exhibit spaces in the balcony. There will be at least 250 exhibitors when the show opens.

The new idea in this exhibit is the uniform installation of all booths at the expense of the management, including partitions, railings, floor coverings, signs and other minor effects, all of which will be in place before the exhibitors move in, thus saving much trouble and expense and reducing the confusion in the last moments of installation of exhibits to a minimum.

The Central Passenger Association gives an excursion rate of one and one-half fares for the round trip, also the Eastern Canadian Passenger Association.

Conventions of the Illinois Lumber Dealers' and Masons' Supply Associations are held the same week and will bring many visitors to the show.

The Northwestern Cement Products Association.

Great interest is shown already in the cement show and convention to be held in Minneapolis, Minn., March 2, 3 and 4, by the Northwestern Cement Products Association. The exhibits will be arranged in the new armory which has been donated to the use of the exhibit by the Commercial Club of Minneapolis, which pays the rental for the building for this purpose. Silver cups are donated by the Commercial Club and the Builders' Exchange of St. Paul, and the Builders' Exchange, and the Manufacturers' Association of Minneapolis, to be awarded as prizes to the exhibitors.

The program for the convention will be announced later. Martin T. Roche, president, St. Paul, Minn., and J. C. Van Doorn, secretary, Minneapolis, will give any desired information.

The Technical Publicity Association.

The November bulletin of the Technical Publicity Association shows that some real progress is being made by that body. The association is composed of the advertising men of concerns manufacturing or marketing technical products, and at monthly dinners held in New York City the subject of advertising and publicity is discussed. At a recent meeting President Redfield spoke on "Foreign Advertising," a talk based on his personal observation of the trade press in England, Germany and France. Prominent among the speakers at the November meeting were John Hadcock, of the Morse International Agency; H. M. Post, advertising manager of the Western Electric Company; S. F. Coleman, advertising manager of the Lidgerwood Manufacturing Company, and J. M. Brock, advertising manager of the Wm. M. Crane Company.

Among the large list of members are men who direct advertising expenditures amounting to many thousands of dollars annually, men who "have got to make advertising pay," and their experience and their views on the subject should carry considerable weight. They are the practical men who really know what pays and what does not. It is hoped, therefore, that the bulletin will soon print the proceedings, or at least the principal address, in full.

The officers of the association are as follows: President, Charles S. Redfield,

advertising manager Yale & Towne Manufacturing Company; first vice-president, Rodman Gilder, publicity manager and secretary Crocker-Wheeler Company; second vice-president, Chas. N. Manfield, manager advertising department H. W. Johns-Manville Company; secretary, H. H. Kress, publicity manager A. S. Cameron Steam Pump Company; treasurer, H. M. Davis, advertising manager Sprague Electric Company.

Application for membership should be addressed to C. W. Beaver, chairman membership committee, 9 Murray street, New York City.

Technical Meetings.

The twenty-third annual convention of the National Brick Manufacturers' Association will be held at Rochester, N. Y., February 1 to 6, 1909. The National Paving Brick Manufacturers' Association convention will be held at the same time, as will also the National Clay Machinery Association.

The Iowa Brick and Tile Association will hold its next convention at Mason City, Iowa, January 13 and 14.

The annual convention of the Iowa Engineering Society will be held at Waterloo, Iowa, January 13 and 14. A. H. Ford, secretary, Iowa City, Iowa.

The annual convention of the Michigan Engineering Society will be held at Ann Arbor, Mich., January 12, 13 and 14. Alba L. Holmes, secretary, 574 Wealthy avenue, Grand Rapids.

The annual convention of the Indiana Engineering Society will be held at Indianapolis, Ind., January 14, 15 and 16. Charles Brossman, secretary, Union Trust Building, Indianapolis.

The annual meeting of the American Society of Civil Engineers will be held in New York City January 20. Charles W. Hunt, secretary, 220 West Fifty-seventh street, New York City.

The annual convention of the Ohio Engineering Society will be held at Columbus, O., January 26, 27 and 28. Paul Hansen, secretary, Harrison Building, Columbus.

The annual meeting of the Illinois Society of Engineers and Surveyors will be held at Chicago, Ill., January 27, 28 and 29. E. E. R. Tratman, secretary, 1636 Monadnock Building, Chicago.

The annual meeting of the Canadian Society of Civil Engineers will be held at Toronto, Ont., January 28. C. H. McLeod, secretary, 413 Dorchester street, West, Montreal, P. Q.

At a meeting of the New England Water Works Association, held December 10, Leonard Metcalf, M. Am. Soc. C. E., presented a paper on "Wrought-Iron Cement-Lined Water Pipe," which was a compilation from matter collected by him for use as an expert witness in the recent appraisal of the property of the Portland Water Company and other companies supplying Portland, Me., and vicinity. L. L. Tribus, M. Am. Soc. C. E., presented a paper describing an attempt to introduce in this country the quite common British system of compensation in kind for water rights taken in connection with surface water supplies.

The twenty-ninth annual convention of the American Water Works Association will be held at Milwaukee, Wis., June 8 to 12, 1909. The headquarters hotel and other local arrangements will be announced later. A good program for this convention is already well assured, good papers being already promised. J. M. Diven, Charleston, S. C., secretary.

At the meeting of the New York Electrical Society held December 16 in the Singer Building, Charles G. Armstrong described the construction of the building and its appurtenances and their operation, and the members of the society inspected all parts of the building.

The sixth annual dinner of the Municipal Engineers of the City of New York will be held at 7 p. m. January 13, at the Hotel Savoy.

The twelfth annual dinner of the Brooklyn Engineers' Club was held at the Brooklyn Germania Club, December 10. The club was addressed by Richard C. Maclaurin, the new president of the Massachusetts Institute of Technology, Wm. T. Sedgwick of Boston, Andrew McLean and Alfred T. White of Brooklyn. James C. Meem was elected president, and Joseph Strachan was re-elected secretary.

Civil Service Examinations.

The United States Civil Service Commission will hold examinations at the usual places as follows:

January 6: Assistant engineer of tests in Ordnance Department at Large, Watertown Arsenal, Mass., at $1,200 a year.

January 6, 7: Hull draftsmen in Light-House Board, Department of Commerce and Labor, at $100 and $125 a month.

January 6, 7, 8: Marine engine draftsman in Light-House Board, at $137.50 a month.

January 13: Metallographist in Ordnance Department at Large, Watertown Arsenal, Mass., at $1,200 a year.

Personal Notes.

Harold A. Parsons has been appointed city engineer at Stamford, Conn.

D. G. Thomas has been appointed chief engineer of the Denver Union Water Company, Denver, Colo.

Francis V. Lister has moved his office to Calle de Don Juan Manuel, No. 20, Mexico, D. F., Mexico.

Herman K. Viele, a civil engineer and artist, died at his home in New York City December 14 of pneumonia.

Charles D. Elliott, the first city engineer of Somerville, Mass., died at his home in that city December 10, aged 71 years.

W. W. Andrews, former borough engineer of Carnegie, Pa., has been succeeded

by the firm of Trimble & Miller, of Pittsburg, Pa.

Ralph Modjeski, of Chicago, has been retained by the bridge department of New York City to make a complete review of the plans of the Manhattan bridge.

R. F. Maddox has been elected mayor of Atlanta, Ga., R. M. Clayton, city engineer, and H. L. Collier was re-elected for the tenth year as commissioner of public works.

Joseph B. Cummings, of Augusta, Ga., was appointed a member of the Chickamauga Military Park Commission by President Roosevelt, December 1, to fill the vacancy caused by the death of Gen. Stewart.

Harry W. De Graff, Asso. M. Am. Soc. C. E., has been appointed deputy State engineer of New York. William B. Landreth, M. Am. Soc. C. E., has been appointed special deputy in charge of barge canal work.

D. D. Waldo, resident engineer of the New York State Department of Highways, Albion, N. Y., died November 30 after a short illness. Mr. Waldo was engineer in charge of the construction of the Goat Island bridge at Niagara Falls and assisted in the harbor construction of the Erie Canal at Buffalo, N. Y.

Charles M. Morse, who has been deputy engineer commissioner of the Department of Public Works, Buffalo, N. Y., for the last seven years, has resigned to take care of his private practice, and Captain Geo. H. Norton has been appointed to succeed him. Captain Norton is a graduate of Cornell University and has been in the department of engineering for twenty years, having charge of bridges, harbor and river work.

MACHINERY AND TRADE

The Dust Nuisance.

At the thirty-third annual meeting of the State Sanitation Association held at Lakewood, N. J., December 4, "The Prevention of Dust on Highways" was discussed by James Owen, county engineer, of Montclair, who said that the sanitary problem created by flying dust was of more importance than that of discomfort or inconvenience. He declared that the advent of the automobile in recent years has brought the question of dust elimination prominently before the public because the dust evil had become so much more pronounced by the machines which tore up the road surface. He said in localities where the roads are improved the most is where the greatest complaints are being made. Housekeepers have their carpets and furniture destroyed, farmers living near much-traveled highways could no longer raise small fruits, and in many cases not even hay, in fields beside the thoroughfares. This, he claimed, tended to depreciate the value of farm lands, and in many cases caused the farmers to fight against the building of improved highways instead of constructing more.

The same condition confronted the people of other lands besides America, and efforts have been made in different parts of the country to abate the dust evil by sprinkling with oil and tar. Some of these efforts, which had proved highly successful in some parts of the country, had proved complete failures in others.

The elimination of dust must be considered under two heads, preventive and palliative. The first was to stop the creation of dust, he said; the second to obviate the nuisance of its existence.

New highways should be constructed so that the wear of the surface would be at a minimum, and to maintain them in that condition. The best surface dressings for this purpose are coal tar, asphalt and crude oil containing asphalt. The latter should not be used in New Jersey, being fitted only for an arid climate.

Mr. Owen then gave an outline of the work being done in various parts of the country with various materials to eliminate dust. He told of what had been found the best methods of applying both tar and asphalt to produce the best results. For New Jersey roads, he claims, a mixtures of asphalt and natural oil to be the best.

A Prosperous Pipe Foundry.

The Lynchburg Foundry Company, owning and operating the McWane Pipe Works, Lynchburg, Va., and the Radford Pipe Works, Radford, Va., have awarded the contract for the structural steel work for a large addition to the special foundry of their Radford works. This addition will be 50 by 125 feet, equipped with electric traveling crane and pits designed especially for the vertical casting of flanged pipe in sizes from 3 inches to 60 inches in diameter and 2 feet to 20 feet in length. The Radford works of this company have been unusually busy on work of this character the past season, among other large contracts being much of the flange pipe for the Pennsylvania General

Terminal Station in New York and a large tonnage for the Cuban mines of the Spanish-American Iron Company.

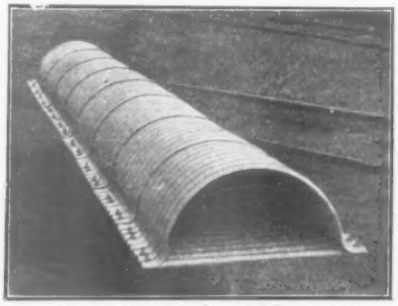
Acme Corrugated Metal Culverts.

The principal objection to corrugated iron culverts has been the danger of rust. It has been ascertained by years of experience that this difficulty can be overcome by using only pure iron. The Acme culverts of the Canton Culvert Company are made of bloom iron, in which all impurities are practically eliminated as compared with about 0.6 per cent in ordinary galvanized sheets. As a consequence an accelerated corrosion test of steel and bloom iron sheets in diluted acid shows scarcely more than one-fourth as much corrosion in the bloom iron sheets as compared with the ordinary galvanized sheets. This leads the company to guarantee their galvanized Acme corrugated metal culverts for twenty-five years.

The sheets are corrugated in half cylinders, which are therefore nestable, greatly facilitating shipping, handling and hauling. An illustration in one of the circulars of the company shows a 40-foot Acme culvert, 5 feet in diameter, in two neat piles on a platform wagon on its way to its location, and a similar culvert set up requiring two wagons, demonstrating how unwieldy it is and how difficult to handle by the very appearance of the photograph. This means large difference in cost for freight and haulage. The first of the accompanying cuts shows a carload consisting of 6,096 lineal feet of culvert of varying diameters, nested and packed in a space 196 inches long, 66 inches high and 58 inches deep. Culverts set up, each 10 feet long and of the same diameters, would require a space 40 feet long, 20 feet high and 10 feet deep. If the car and wagon loads required are counted, the saving in freight and haulage can be estimated.

The second of the accompanying cuts shows a flat-bottomed culvert set up. This form is only used in special cases, but it shows clearly the method of bolting the top and bottom sections together. The same method is used in bolting two semi-cylindrical sections together to form the full circular cylinder, and the impossibility of slipping of one section on the other, as well as the unusual strength of the junction, are clearly shown. Sections on top and bottom are arranged to break joint so that the culvert retains the full strength of single sections. This is shown by the third cut, which shows a 12-ton traction engine standing on an 18-inch culvert, most of the weight being on a single culvert, the six being used to support the engine on its way to the position in which it is photographed. It should be noted that the culvert shown in the picture is not supported on bottom or sides, as it would be if in the ground, nor is there the same distribution of weight on the top, the weight being largely concentrated on the top of the corrugations immediately under the wheels of the engine. The corrugated cylinders are said to be twenty-nine times as strong as plain round cylinders.

I. A CARLOAD OF CORRUGATED PIPE CULVERT, TO LAY 6096 FEET.



II. A FLAT-BOTTOMED CORRUGATED CULVERT.

III. CORRUGATED CULVERT PIPE IS STRONG.

Full information about these money-saving appurtenances to roads, railroads, embankments and the like will be given by the Canton Culvert Company, Canton, Ohio.

Controlling Valve for Water Works.

It is often necessary to have an automatic valve for regulating the flow of water into a reservoir, standpipe or tank, so as to prevent emptying or overflowing, by keeping the level of the water as nearly constant as possible. A hand valve can be used, but it requires attention at the proper times and may be located at such a distance as to make the numerous trips inconvenient and expensive. Floats may be used where the water surface is protected from freezing in all cases, but especially in those named, the simplex controlling valve can be used to advantage. It consists of a valve operated by hydraulic pressure. This pressure is applied to either side of the piston, through the action of a float on a chamber of mercury. The level of the mercury in this chamber is affected by the pressure of the water in the volume to be regulated upon a closed vessel of mercury between which and the float chamber the mercury flows according to the pressure of the water upon it.

Another valve for controlling the rate of flow, keeping it constant whatever the head on the pipe within certain limits, is a Venturi tube and a valve operated by a piston or float which moves with change in the difference in pressure in the full and contracted sections of the tube. The piston is balanced by a counterweight which can be set for any given rate of flow.

A photograph will be found on another page showing an isolated reservoir where this apparatus is in use with great saving of time and trouble. The Simplex Valve and Meter Co., 112 N. Broad St., Philadelphia, Pa., install the apparatus and will give full information about it.

Some Special Instruments for Engineers and Surveyors.

The firm known since the beginning of instrument manufacture in this country by the name of Gurley is at all times studying the needs of engineers and making instruments to suit them. It would take a continued story for a year to describe all the special instruments they catalog, and there are many others made to order to meet fixed and peculiar requirements.

Their explorer's transit seems to include all the necessities of an instrument and at a minimum of weight. The transit, tripod and box in all weigh only fourteen pounds, of which the box is four. They fill about two-thirds of a 24-inch dress-suit case. The horizontal and vertical circles are each 4 inches in diameter, and the instrument has the full equipment of levels, verniers, needle, variation arc, stadia wires, etc., of the regular engineer's transit with such modifications as may be ordered. The accuracy of the work that can be done with such an instrument, when due attention is paid to the effect of wind, sun and handling upon so light a machine, is surprising. Careful adjustments and focusing as well as careful observations will produce results comparable with those obtained with larger instruments.

The firm's current meters are specially well known on the market and include several very ingenious designs.

Leveling rods are specialties of the firm and any standard or special design is readily obtainable. A recent handsomely illustrated catalog in colors shows seventeen designs of leveling and stadia rods which are kept in stock, as well as flagstaff, levels for attachment to rods, and the flexible or tape-line rod.

A card to W. & L. E. Gurley, Troy, N. Y., will bring full information about any standard or special instrument desired.

Blades for Road Scrapers.

The Shunk Plow Company has been in the steel and iron business since 1854. This long experience of fifty years enables them to get the best possible material for the manufacture of their various products. This especially pertains to cutting edges, where the quality and the mixture of the steel is the all-important point upon which the life of the cutting edge depends. They have been manufacturing cutting edges for fifteen years and have made the demands of this trade a special study.

Years ago they arranged with a large steel mill for a special mixture of steel to be used exclusively in their edges. They also secured special rolls for rolling cutting edges. Securing the best material for the purpose and handling it in a manner which years of experience has proven to be the best, they have not had a single complaint on their cutting edges or their wearing qualities.

Any blacksmith can take a piece from one of their blades and forge a good cold chisel that will do the work and stand the wear of the very best chisel made. This is based on practice and not on theory, as they have in their factory many chisels made of this material.

They sell direct to the consumer at a price that is consequently low.

They furnish blades for all the grading machines in the market or can supply any special form promptly on order.

They also supply an excellent plow for road work, sewer castings, plain and ornamental metal hitching posts and other iron and steel specialties. Address the company at Bucyrus, O.

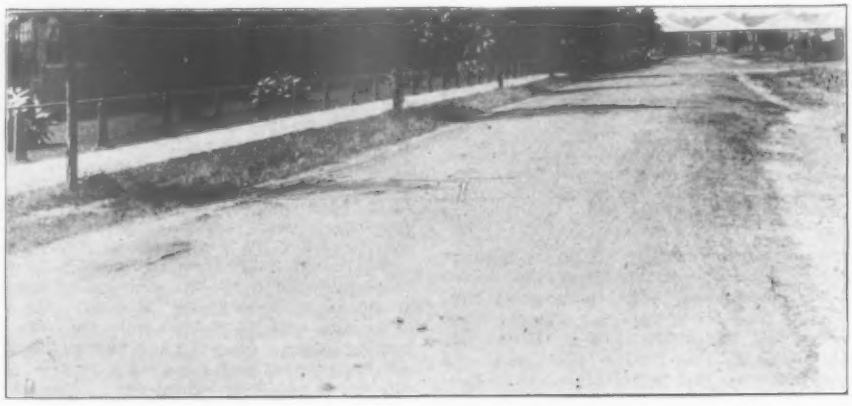
A Test of Continuous Concrete Pipe.

A recent test of the Meriwether reinforced concrete pipe was made by putting together three sections of 36-inch pipe, supporting them on blocks near the outer ends of the outer sections and then load-

ing the center section by adding weights on a beam, which was supported on two saddles resting one on each side of the middle of this center section. A load of 10,550 pounds was thus concentrated on the hollow cylindrical beam made of the three pipes with no sign of crack or failure in either pipe or joints. The sections were partly filled with water to prove the absence of cracks in the joints.

The Dustless Testing Track.

The problem of preserving macadam on motor roadways appeared in its most intense form when the Thomas B. Jeffrey Company of Kenosha, Wis., undertook to build and maintain a half-mile track for testing their automobiles. It is the custom at this factory to give all the Rambler cars a test of 200 miles' driving on the testing track. The output of the factory is very large, so that fifteen or twenty



TARVIATED AUTOMOBILE TESTING TRACK AT KENOSHA, WIS.

cars are running at high speed over the track every hour of the day. Ordinary macadam would, of course, fail under such a test, and the dust would be unbearable, especially at the turns. Various oil treatments and compounds were experimented with and the Tarvia treatment was finally adopted. It was found entirely satisfactory. The surface is entirely without dust, is impervious to water and is so elastic that wear on the tires has been greatly reduced.

The success of Tarvia on the Rambler track has been so marked that it has led to the use of this material on all the roads surrounding the factory.

Handbook of Instruments for Engineers.

The Bausch & Lomb Optical Company, of Rochester, N. Y., of which Mr. Geo. N. Saegmuller, formerly sole proprietor of Fauth & Co., of Washington, D. C., is now a member, announce their "Handbook for Engineers" for 1909.

This book, of vest-pocket size, contains the solar ephemeris for 1909 and also directions for using the Saegmuller solar attachment, now so universally employed. There are directions with diagrams for using and adjusting the engineers' wye level, the dumpy level and the transit instrument, as well as other useful information. This book is of interest to all engineers and students of engineering. It will be sent at once free of charge upon request.

Trade Publications.

The Overturf collapsible molds for the construction of culverts, drains, irrigation channels and sewers are shown in a catalog issued by C. W. Overturf & Co., Dumont, Iowa.

Catalog No. 100 of Thos. H. Dallett Co., Philadelphia, Pa., is devoted to air compressors.

Bulletin No. 1 of the Chapman Valve Mfg. Co., Indian Orchard, Mass., is devoted to electrically operated valves.

A slip indicator for large pumping engines is described in a recent pamphlet of the Pitometer Co., New York.

The Ashley system of house sewage disposal is described in a fully illustrated pamphlet issued by B. J. Ashley, 6515 Normal Boulevard, Chicago, Ill.

Striking features of the December bulletin of the Universal Portland Cement Co. are the illustrations of floating reinforced concrete caissons used at Algoma, Wis., and the Ft. St. Philip sea wall near New Orleans, La.

The Alma Cement Co., Wellston, O., reprints the article on sewage disposal in Columbus, O., from the October number of MUNICIPAL ENGINEERING and is distributing it among its friends and prospective customers. Alma cement was used exclusively in the work, 40,000 barrels being required.

The Ironton Portland Cement Co., Ironton, O., is distributing for advertising pur-

poses the little "Cement Worker's Handbook," compiled by W. H. Baker, which has been on the market for two or three years at a price of 50 cents.

The latest Miracle concrete bulletin is devoted mainly to concrete culverts and pipe and fence posts and their manufacture by the Miracle apparatus. A card to the Miracle Pressed Stone Co., Minneapolis, Minn., will bring it.

The Trussed Concrete Steel Co., Detroit, Mich., send circulars descriptive of Trus-Con liquid waterproofing, a transparent surface waterproofing applied with a brush, and Trus-Con frigite, a crystalline chimical compound which is dissolved in the water for concrete and prevents freezing until the concrete has set, and even increases the strength of the fully hardened concrete.

The Dallas Cement Stone Works, Dallas, Tex., send a portfolio of pictures of handsome buildings for which they have supplied artificial stone for walls, for trimmings, for cornices, for ornamental carving, capitals, columns and bases, elaborate castings of figure pieces and other ornamental models, also a number of plain and elaborate designs of tombstones. They show that the highest artistic and architectural successes can be made by those who will attack the problems in the proper way and under the proper guidance and instruction.

A recent circular of the Wm. G. Hartrauft Co., Real Estate Trust Bldg., Philadelphia, Pa., shows the concrete dry dock No. 3 of the Newport News Ship Building and Dry Dock Co., which is built of Old Dominion Portland cement, made by the Virginia Portland Cement Co.

Calendars have been received from the following firms: Alma Cement Co., Wellston, O.; J. W. Butler Co., Chicago, Ill.; The Dominion Bank, of Toronton, Montreal and Winnipeg; The Deckman-Duty Brick Co., Cleveland, O.

The December bulletin of the Corrugated Bar Co., National Bank of Commerce Bldg., St. Louis, Mo., is devoted to reinforced concrete reservoirs, and gives formulae, notes and suggestions on design, specifications for materials, methods of waterproofing, and a detailed design for a rectangular reservoir with 18 feet depth of water and earth embankment on the opposite sides of the reinforced concrete wall forming the walls of the structure.

McVean & Kellogg, consulting engineers, Grand Rapids, Mich., publish a little pamphlet entitled "What Shall We Do With the Sewage of Our City or Village?"

The "Opportunity Number" of the *Real Estate Record and Builders' Guide* of New York City establishes a new record even in the fine history of that long established and masterly publication. Its advertisements are admirably presented, its subject matter most instructive, its editorials able. In a word it is an illuminating issue and rightly named "Opportunity Number."

Trade Notes.

ASPHALT.

Aberdeen, Wash.—An asphalt plant will be erected here by Andrew Peterson, of Tacoma, who has purchased a large amount of land along the Wishkah River.

Mobile, Ala.—The board of public works has directed Wright Smith, chief engineer, to prepare plans and specifications for a municipal asphalt plant to take care of the asphalt-paved streets of this city.

CEMENT.

Tacoma, Wash.—The Superior Portland Cement Co. has established an office at Tacoma, Wash., in charge of Stebbins, Semmes, Spinning, Inc.

Havre, Mont.—The establishment of a cement plant is contemplated here.

Mason City, Ia.—The construction of a cement mill will begin soon. The Lehigh Company, of Lehigh, Pa., will construct the plant.

Jersey City, N. J.—The Bushkill Portland Cement Co. has been incorporated by George A. Lermann, James W. Houks and William H. Rees.

Des Moines, Ia.—The cement plant of the Iowa Portland Cement Co. is nearing completion and expects to begin operating next February.

Monroe, La.—The Downes Cement Co. has been reorganized with officers as follows: President and business manager, R. Downes; vice-president, G. E. Downes; superintendent of construction, J. E. Lightfoot. The company constructs sidewalks and concrete work of all kinds.

The Atlas Dryer Co., of Cleveland, O., have removed their offices to the Citizens' Building, and will be glad to receive calls from visitors to the cement exhibition to be held in Cleveland in January in connection with the meeting of the National Association of Cement Users.

The Sandusky Portland Cement Co., of Sandusky, O., are supplying their white Portland ceemnt for use in the following important contracts: For exterior cement stucco on Davis-Schonwasser Bldg., San Francisco, Cal.; in mausoleum being erected at Swanton; Masonic Temple building, St. Louis, Mo.; for lining and finishing swimming pool at Sanford public bath, St. Louis, Mo.; in work on the Capitol building at Santa Fe, N. M.; on the Seaview Hospital, Staten Island, N. Y.; Swift's Engineering building, Northwestern University, Chicago; for exterior stucco finish on the White garage, San Francisco; for exterior stucco finish on the new Taylor residence at Clairmont Park, Cal.; for pointing Bedford stone on the new Temple Israel, St. Louis; for the House office building, Washington, D. C.

They are also furnishing their waterproof compound in the following important work: Presbyterian Hospital, Chicago, Ill.; new Washington Hotel, Seattle, in basement floor work; on John Jacob Astor estate, Rhinebeck, N. Y.; new city insane asylum, St. Louis, Mo.; in city reservoir construction at Oil City, Pa.; Studebaker private residence at South Bend, Ind.; People's Gas, Light and Coal Co. receiving pit, Chicago; U. S. Navy Yard, Puget Sound, Wash.; Nevada ice and cold storage plant for Southern Pacific Railway Co.; Auditorium swimming tank, St. Louis, Mo.; for cement roofs on planing mill and power house at Wausau, Wis.

CONCRETE BLOCKS.

Des Moines, Ia.—The Jacoby Building Material Co. has opened offices at 409-410 Fleming Bldg. A complete line of materials, brick and clay predominating, will

be represented, and all varieties of brick, tile, sewer and gutter pipe, etc., will be handled.

New York City.—The Ficklen Concrete Construction Co. has been incorporated with directors as follows: William E. Ficklen, 1 Madison ave.; Albert K. Newman and William L. Bowman, 38 Park Row, New York City.

Zumbrota, Minn.—The Zumbrota Clay Co. decided, at its annual meeting, to issue bonds and get its plant in operation during the coming season.

Wilkes-Barre, Pa.—James E. McKeon, 67 E. Northampton st., has invented a new concrete mixer.

London, Ont.—The London Concrete Machinery Co. has been incorporated.

Herkimer, N. Y.—The Herkimer Cement Products Co. has been incorporated with the following directors: Daniel F. Strobel, Charles M. Kellogg and Louis S. Leonard, Herkimer, N. Y.; Gorham Smith, H. D. McIntosh and C. A. Whelden, of Ilion; Alfred Crozier, of Wilmington, Del.

Des Moines, Ia.—The Iowa Portland Cement Co. expects to commence grinding next February. Its plant, which is nearing completion, covers 21 acres.

Des Moines, Ia.—The Enamel Concrete Co. contemplates the erection of a building for the manufacture of machines to produce enamel concrete building blocks.

Clark, S. D.—R. E. Heggy, a cement block and sidewalk contractor of Aberdeen, S. D., contemplates erecting a plant here.

Cumberland, Wis.—L. M. Engesether contemplates establishing a concrete block plant.

Waterville, Minn.—J. Walker Pope, of Minneapolis, and A. H. Fuller, of Fairmont, Minn., contemplate the erection of a cement tile plant here.

Sheboygan, Wis.—Herbert Bliss is erecting a building and will manufacture cement shingles and building materials.

Huron Lake, Minn.—William Talbot and Walter Poss have established a cement tile manufacturing business in the Cabot building.

Minneapolis, Minn.—John G. Granberg and G. Granberg have begun the manufacture of cement concrete building blocks, under the name of the Sterling Cement Works, at 3448 Fifth ave., S.

PURCHASE OF MACHINERY.

Missoula, Mont.—Bids are asked until Jan. 4 for delivering f. o. b. from four to twelve sprinkling wagons of various sizes and materials.

Charleston, S. C.—This city contemplates purchasing, about Jan. 1, six watertight dump carts and one or two sprinklers. J. H. Dingle, cy. engr.

North Vancouver, B. C.—Bids are asked until Jan. 25 for road machinery as follows: Compound steam 10-ton road roller with scarifier attached; hand truck for fuel oil and tool tender for roller; water cart with distribution pipe and suction hose; traveling van and two traction wagons of 4-ton capacity; portable compound toggle knapping motion stone breaker with screens, elevating and loading machinery; electric motors with belt and belt attachments for driving the stone breaker, etc.; air compressor of sufficient capacity to supply air for driving three pneumatic 2¼-in. drills, an air receiver of 34 cu. ft. capacity with necessary connections and pipes, and three 150-ft. lengths of armored ¾-in. hose suitable for the pressure; three Sullivan or Little Giant rock 2¼-in. drills with tripods, weights and complete set of drills each; a Murphy air hammer rock drill with complete outfit. Donald Cameron, dist. engr.; Alex. Philip, clk. munic. council.

Riverside, Cal.—Special.—The McIntyre Cement Co., 150 Main st., advises us that they are in the market for a 10-ton steam or gasoline road roller.

Spearfish, S. D.—Special.—G. F. Stebbins, mayor, is in the market for road and water machinery and tools.

Kirksville, Mo.—Special.—Tyler Paine advises us that he is in the market for road tools and bridges.

Atchison, Kan.—Special.—J. A. Spalding, sec. and treas. of the Atchison Gravel, Sand and Brick Co., advises us that he is in the market for an air compressor for rock drill.

Horton, Kan.—Special.—Al Frey is in the market for a small stone crusher.

Minneapolis, Minn.—Special.—The Minnesota Paving Brick Co., 10 N. Third st., advise us that they are in the market for a machine to take stone out of clay.

Goldsboro, Md.—Special.—J. H. Williams advises us that he is in the market for a cement block machine.

Spencerville, O.—Special.—W. H. Pickering is in the market for a mixer suitable for small jobs.

Indianapolis, Ind. — Special. — T. E. Kane, 1121 N. Alabama st., desires to purchase wheelbarrows and shovels.

Haverhill, Mass.—Special.—W. F. Duffee & Co., 208 Main st., is in the market for a power mixer for sidewalk use.

Meadville, Pa.—Special.—W. F. Nipples, 839 Market st., desires to communicate with companies which manufacture sand mills or crushers for crushing soft sandstone.

Melrose, Mass.—Special.—R. Philpot, 76 Dell ave., advises us that he is in the market for a steam shovel.

Marengo, Ind.—The stone crushing plant of the Marengo Mfg. Co. was destroyed by fire recently, entailing a loss of about $6,000. The company will probably rebuild at once.

PURCHASE OF MATERIALS.

Portland, Ore.—Bids are asked until Jan. 15 for furnishing 25,000 bbls. of Portland cement. U. S. Reclamation Service, 417 Beck Bldg.

Indianapolis, Ind. — Special. — T. E. Kane, 1121 N. Alabama st., desires to purchase cement.

Spencerville, O.—Special.—W. H. Pickering is in the market for cement.

Goldsboro, Md.—Special.—J. H. Williamson advises us that he is in the market for cement in car lots.

Kirksville, Mo.—Special.—Tyler Paine desires to purchase cement, crushed rock, sand, brick and tile.

Spearfish, S. D.—Special.—G. F. Stebbins, mayor, is in the market for pipe and tiling.

SEWER PIPE.

Fergus Falls, Minn.—The establishment of a plant for the manufacture of cement sewer pipe is proposed by Edward Peterson and Albert Holmgren.

Patents Concerning Reinforced Concrete.

855,204. Reinforcing Bar for Concrete Structures. Edson M. Scofield, Philadelphia, Pa.

855,240. Reinforcing Member for Concrete Construction. Wm. D. Forsyth, Pittsburg, Pa.

855,299. Reinforced Concrete Construction for Buildings and Other Structures. Geo. Georgenson and Joseph E. Hennen, Fond du Lac, Wis.

856,013. Armored Cement or Concrete Construction. Gaetan Ajello, New York, N. Y.

856,695. Armored Cement or Concrete Construction. Gaetan Ajello, New York, N. Y.

857,671. Reinforcing Bar for Concrete. Amedee V. Reyburn, Jr., St. Louis, Mo.

857,775. Reinforced Concrete Construction. Chas. P. Walter, Harrisburg, Pa.

857,973. Construction of Reinforcing-Steel for Reinforced Concrete Beams and Girders. Gunvald Aus, Brooklyn, N. Y.

858,153. Reinforcement for Concrete. Winfield W. Conard, Norristown, Pa.

858,410. Metal Structure for Reinforcing Concrete. Otto N. Mueller, Indianapolis, Ind.

858,693. Reinforcing Bar. Herbert E. White, Youngstown, O.

859,311, 859,312, 859,313, 859,314, 859,-315. Reinforce for Concrete. David Maxwell, Detroit, Mich.

859,858. Steel Skeleton Construction for Concrete Buildings. C. A. P. Turner, Minneapolis, Minn.

860,391. Reinforced Concrete Structure. Samuel H. Lea, Pierre, S. D.

861,502. Reinforced Concrete Building Construction. John T. Cochran, Oakland, Cal.

861,860. Girder. Henry P. Jones, Braintree, Mass.

861,930. Girder or Beam. Pierre Zucco, New York City.

862,254. Corrugated Bar. Albert L. Johnson, St. Louis, Mo.

862,897. Expanded Metal. Wm. D. Forsyth, Pittsburg, Pa.

862,898. Fastening Device. Wm. D. Forsyth, Pittsburg, Pa.

863,555. Reinforced Concrete Beam or Column. Edward C. Poole, Southampton, England.

863,959. Reinforcing Bar for Concrete, etc. Sydney B. Williamson, Baltimore, Md.

865,145. Reinforced Concrete Construction. Samuel B. Zimmer, Oakland, Cal.

865,231. Reinforced Concrete Structure. Eldridge R. Boyle and Wm. B. Upton, Washington, D. C.

865,477. Reinforced Concrete Structure. Herbert F. Cobb, Cleveland, O.

865,489, 865,490. Reinforced Concrete Construction. Geo. M. Graham, Chicago, Ill.

865,963. Concrete Beam. Ferdinand Barre, Baltimore, Md.

866,460, 866,461. Beam Frames for Reinforced Concrete. Hugo Haiss, Pittsburg, Pa.

866,715. Reinforced Concrete Structure. Herbert F. Cobb, Cleveland, O.

867,090. Concrete Bar. Frederick G. Wolf, Youngstown, O.

867,665. Reinforced Concrete Structure. Chas. Mankedick, Sullivan, Ind.

867,802. Reinforced Concrete Jetty. Wm. C. Cottrell, Asbury Park, N. J.

867,818. Reinforced Concrete Step. Geo. M. Graham, Chicago, Ill.

868,065. Concrete Reinforcement. John S. Bonnes, Detroit, Mich.

868,921. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

869,274. Reinforced Concrete Construction. Edward Nichols, Cohasset, Mass.

870,129. Reinforcing Bar for Concrete Structures. Arthur Priddle, San Francisco, Cal.

870,588. Reinforced Concrete Structure. Alson Rogers, Warren, Pa.

871,017. Means for Supporting Reinforcing Rods for Cement Structures. Albert Witte, Cincinnati, O.

871,075. Reinforced Steel Beams. Eric Swensson, Minneapolis, Minn.

871,076. Reinforced Steel Column. Eric Swensson, Minneapolis, Minn.

871,504. Reinforcing Bar. Max Haupt, Homestead, Pa.

871,568. Concrete Floor Structure. Fred H. Daniels, Worcester, Mass.

871,655. Reinforced Vault. Edward J. Winslow, Chicago, Ill.

871,699. Concrete Reinforcement. Carl Horix, East Cleveland, O.

872,127. Reinforcing Means for Composite Structures. John F. Havemeyer, Ardsley-on-Hudson, N. Y.

874,226. Reinforced Concrete Construction. John W. Muldoon, New York, N. Y.

874,413. Means for Reinforcing Composition Construction of Ceilings, Walls, etc. Wallace C. Lyon, Hyattsville, Md.

874,729. Reinforced Concrete Door Structure. Titus de Bobula, Pittsburg, Pa.

875,158. Reinforcing Frame for Concrete Building Construction. M. L. Cooper, Modesto, Cal.

875,699. Reinforced Concrete Composite Structure (crib work). Paul T. C. Dumais, Hull, Quebec, Can.

875,804. Reinforced Concrete Building. Geo. M. Graham, Chicago, Ill.

875,975. Reinforced Concrete Flooring. Wm. P. Anderson and Louis H. Nolte, Cincinnati, O.

876,471. Means for Reinforcing Concrete. Edmond G. du Maguel, New York, N. Y.

876,480. Reinforcing Concrete. Otto N. Mueller, Indianapolis, Ind.

876,694. Reinforced Concrete Construction. Francois N. Conutot, Chicago, Ill.

877,734. Reinforced Concrete Construction. Richard G. Reuther, Detroit, Mich.

879,164. Fitting for Reinforced Concrete Structures. Geo. M. Graham, Chicago, Ill.

879,444. Metallic Reinforcing Structure for Cementitious Bodies. Edward F. Crane, Newark, N. J.

880,820. Reinforcing and Tension Device for Concrete Structures. Arthur S. Pierson, Morristown, N. J.

881,617. Metallic Reinforcement for Concrete Structures. Ethelber D. Pitt, Niagara Falls, Ont., Can., and Laforest G. Robinson, Plattsburg, N. Y.

881,618. Concrete Reinforcing Bar. Wm. W. Ramsey, Chicago, Ill.

881,762. Reinforcing Bar. Edward L. Adreon, Jr., St. Louis, Mo.

881,834. Reinforced Bar for Concrete. Chas. F. Varney, New York, N. Y.

882,216. Reinforced Concrete Construction. Pietro Stragiotti, Berkeley, Cal.

882,273. Bar for Reinforced Concrete Construction. Edwin E. Slick, Pittsburg, Pa.

883,164. Chimney or Stack (Concrete). Oscar T. Benson, Worcester, Mass.

883,768. Reinforcing Frame and Cementitious Construction. Alex. P. White, Caldwell, N. J.

884,010. Unit Reinforcement for Concrete Construction. Robert A. Cummings, Beaver, Pa.

884,090. Bar for Reinforcing Concrete. Chas. E. Johnson, Detroit, Mich.

884,306. Reinforced Concrete Construction for Buildings. Harlan H. Wheeler, Maywood, N. J.

884,341. Metal Reinforce for Concrete. Wm. W. Ramsey, Chicago, Ill.

885,158. Expanded Metal. Julius Kahn, Detroit, Mich.

885,240. Fitting for Reinforced Concrete Structures. Geo. M. Graham, Chicago, Ill.

885,525. Column. Wm. H. Roney, Chicago, Ill.

887,863. Steel Girder Frame for Rein-

forced Concrete Girders. Edgar N. and Ralph E. Spaulding, Suffield, Conn.

886,671. Concrete Floor Construction. Frederick C. Taxis, St. Louis, Mo.

888,999, 889,000. Reinforced Concrete Floor and Ceiling, and Roof. Geo. M. Graham, Chicago, Ill.

889,083. Reinforced Concrete Construction. Robert H. Aiken, Winthrop Harbor, Ill.

Patents Concerning Hydraulics.

795,057. Hydrant. Dennis F. O'Brien, Newark, N. J.

795,650. Flood Gate. Georg Ruhlmann, Strassburg, Germany.

795,739. Water Level Indicator. Ross R. Stollar, Longbeach, Cal.

795,839. Water-Tight Butt Joint. Frank C. Kelsey, Salt Lake City, Utah.

795,964. Non-Freezing Hydrant. Carleton Ellis, Boston, Mass.

807,010. Waste Gate for Dams. Nils F. Ambursen, Newton, Mass.

828,752. Dam. Geo. E. Ladshaw, Spartanburg, S. C.

838,509. Hydrant and Valve Mechanism for the Same and Other Purposes. Denis F. O'Brien, Newark, N. J.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Council Bluffs, Ia.—Paving is contemplated for Broadway.

Marshalltown, Ia.—Paving is contemplated for W. Church and N. 13th sts.

Toledo, O.—New bids will be asked for repaving Collingwood ave.

Duluth, Minn.—About 2 miles of tar macadam paving is proposed for 6th st.

Seattle, Wash.—About 1,000 ft. of paving will be laid along Duwamish river.

Green Bay, Wis.—The construction of cement sidewalks is contemplated.

Kansas City, Mo.—The bd. of pub. wks. has decided to pave Broadway and 14th sts.

Eugene, Ore.—Ordinances have been passed for paving Oak, Olive, E. 11th, Pearl and E. 10th sts.

Wallace, Idaho—Council has under consideration the question of paving the business streets.

Jackson, Miss.—Brick paving is contemplated for 1 block of Gallatin st. Hamilton Johnson, cy. engr.

Shenandoah, Ia.—Contracts will be let during January for about 2 miles of creosoted wood block paving.

Atlanta, Ga.—The construction of about 6 miles of boulevard from College Park to Atlanta is contemplated.

Shelby, N. C.—Special.—J. L. Suttle, mayor, desires to purchase materials for paving sidewalks and streets.

Albany, N. Y.—An ordinance has been passed providing for the repaving of N. Pearl, N. Ferry and Broadway sts. with asphalt.

Pekin, Ill.—City council has decided to pave or macadamize the grade on the west side of the river for a distance of 1¼ miles.

The Dalles, Ore.—Special.—E. M. Wingate advises us that he is interested in the proposed purchase of materials for street paving.

Hoquiam, Wash.—The joint committee of the city council and the Commercial Club reported in favor of vitrified brick paving for 8th and I sts.

Huntsville, Ala.—The city council has confirmed an ordinance providing for vitrified brick paving in W. Clinton st. with vitrified brick gutters.

Ada, Okla.—The city council rejected the bids submitted recently for vitrified brick paving, and has passed a resolution asking for bids for concrete paving.

La Crosse, Wis.—The bd. of pub. wks. has recommended paving for a number of streets next year, and has suggested tar macadam, granite top dressing macadam, and brick paving.

Grand Forks, N. D.—The city engineer has been directed to prepare plans and specifications for paving N. 4th, N. 5th, 3rd, S. 6th and 5th sts., International, 4th, Reeves, Belmont and 8th aves.

CONTRACTS TO BE LET.

Toledo, O.—Bids are asked until Jan. 15 for paving Hawley st. B. P. S.

Natchez, Miss.—Bids are asked until Jan. 4 for constructing a road. Co. comrs.

Geneva, Neb.—Bids are asked until Jan. 12 for grading work. U. F. Stanard, co. clk.

Fowler, Ind.—Bids are asked until Jan. 4 for constructing roads. L. Shipman, co. audt.

Covington, Ind.—Bids are asked until Jan. 5 for constructing a gravel road. W. B. Gary, co. audt.

Danville, Ind.—Bids are asked until Jan. 4 for constructing gravel roads. W. H. Nichols, co. audt.

Peru, Ind.—Bids are asked until Jan. 7 for constructing gravel roads. Chas. Griswold, co. audt.

Greenfield, Ind.—Bids are asked until Jan. 4 for improving certain roads. Chas. H. Troy, co. audt.

Tipton, Ind.—Bids are asked until Jan. 5 for constructing a gravel road. J. F. Barlow, co. audt.

Lebanon, Ind.—Bids are asked until Jan. 5 for constructing a gravel road. B. F. Herdrich, co. audt.

Washington, Ind.—Bids are asked until Jan. 5 for constructing 5 gravel roads. Thos. Nugent, co. audt.

Brownstown, Ind.—Bids are asked until Jan. 5 for constructing gravel roads. H. W. Wacker, co. audt.

Huntington, Ind.—Bids are asked until Jan. 4 for improving a road in Brown twp. Bennett B. Engle, co. audt.

Muskogee, Okla.—Bids are asked until

Jan. 4 for paving 7th st. with natural lake asphalt. Morgan Caraway, cy. clk.

Wabash, Ind.—Bids are asked until Jan. 5 for constructing a number of gravel roads. J. P. Noftzger, co. audt.

Newcastle, Ind.—Bids are asked until Jan. 5 for constructing a gravel road in Fall Creek twp. W. L. Risk, co. audt.

Harrisburg, Pa.—Bids are asked until Jan. 8 for reconstructing certain roads. Jos. W. Hunter, State highway comr.

Flemington, N. J.—Bids are asked until Jan. 14 for macadamizing 30,979 ft. of road. John W. Sharp, dir. co. freeholders.

Griffith, Ind.—Bids are asked until Jan. 2 for constructing cement sidewalks in Factory ave. M. J. Bairigen, town clk.

Williamsport, Ind.—Bids are asked until Jan. 4 for constructing a gravel road in Liberty twp. Robt. L. Winks, co. audt.

Mount Pleasant, Mich.—Bids are asked until Jan. 4 for paving Main st. with asphalt or macadam. Augustus Borden, cy. clk.

Pensacola, Fla.—Bids are asked until Jan. 18 for constructing 634,000 sq. ft. of concrete sidewalks. L. Earle Thornton, cy. engr.

Muncie, Ind.—Sealed bids are asked until Jan. 6 for improving a certain highway in Delaware twp. Jos. E. Davis, co. audt.

Rockville, Md.—Bids are asked until Jan. 12 for grading and macadamizing about 3¼ miles of road. Robt. G. Hilton, clk. co. comrs.

Hartford City, Ind.—Bids are asked until Jan. 4 for constructing gravel roads in a number of townships. L. W. Daugherty, co. audt.

Columbus, Ind.—Bids are asked until Jan. 4 for constructing 13,164 ft. of gravel road in Harrison twp. John M. Davis, co. audt.

Sullivan, Ind.—Bids are asked until Jan. 5 for constructing 4,350 ft. of stone road in Hamilton twp. Ben. C. Crowder, co. audt.

Rushville, Ind.—Bids are asked until Jan. 4 for paving a highway in Rushville twp. with crushed stone. Albert L. Winship, co. audt.

Charleston, W. Va.—Bids are asked until Jan. 6 for constructing 110,;00 sq. yds. of paving and 47,580 ft. of curbing. W. A. Hogue, cy. engr.

Madison, Ind.—Bids are asked until Jan. 6 for grading, draining, paving and macadamizing a road in Monroe twp. Gaylord F. Crozier, co. audt.

Appleton, Wis.—Bids are asked until Feb. 1 for paving Washington st. with creosoted wood blocks on a concrete foundation. E. L. Williams, cy. clk.

Olympia, Wash.—Bids are asked until Feb. 1 for constructing 6,000 sq. yds. of vitrified brick or creosoted wood block paving. J. R. Dover, cy. clk.

CONTRACTS AWARDED.

Chickasha, Okla.—The contract for constructing 8 miles of paving was awarded to C. A. Heman.

Aberdeen, Wash.—The contract for paving Wishkah and H sts. was awarded to Andrew Peterson for $102,701.

Anderson, Ind.—The contract for constructing a gravel road was awarded to John B. Mason, of Alexandria, Ind.

Winamac, Ind.—The contract for constructing a highway was awarded to Jacob Quigley, of Pulaski, Ind., for $5,000.

Crawfordsville, Ind.—The contract for improving a road was awarded to O'Connor & Sons, of this city, for $6,792.

Independence, Ia.—A paving contract has been awarded to the J. W. Turner Co., of Des Moines, for $25,000.

Lebanon, Ind.—The contract for constructing 2 gravel roads was awarded to West Bros. at $2,343 and $5,100 respectively.

Portland, Ore.—The contract for paving Belmont st. with bitulithic was awarded to the Pacific Bridge Co. for $86,000.

Huntington, Ind.—The contract for building 2 gravel roads was awarded to Garrett & Brenneman, of Bluffton, Ind., for $12,820.

Huntington, Ind.—The contract for constructing a macadam road was awarded to Conover & Taber, of Laporte, Ind., for $5,700.

Bremerton, Wash.—The contract for constructing a cement sidewalk in Pacific ave. was awarded to Chas. A. Worth at $1.16 a sq. yd.

Houston, Tex.—The contract for paving San Jacinto, Preston and Dowling sts. was awarded to John C. Underwood, of this city.

Greenfield, Ind.—The contract for improving a public highway was awarded to Ewing Shields, of Seymour, Ind., for $11,150.

Tacoma, Wash.—The contract for constructing sidewalks in S. 54th, Railroad and 56th sts. was awarded to Chas. G. Schafer for $7,280.

Vernon, Ind.—The contract for constructing about 2¾ miles of pike roadway was awarded to J. M. Childers, of this city, for $5,400.

Oklahoma City, Okla.—The contract for constructing sidewalks in various sections of the city was awarded to M. F. Crawford for $1,364.

Newark, N. J.—The J. F. Shanley Co. was awarded the contract, Dec. 3, for paving Market st. with creosoted wood block paving for $89,585.

Goshen, Ind.—The contract for paving S. Main st. with asphalt was awarded to the Andrews Construction Co., of Hamilton, O., for $45,109.

Anniston, Ala.—The contract for constructing cement sidewalks was awarded to J. S. Contiff & Co., of Montgomery, at 87¾ cents a sq. yd.

Brooklyn, N. Y.—M. F. Hickey was awarded the contract for repaving with granite on concrete, 2nd ave. from Hamilton ave. to 6th st. for $39,549.

Salt Lake City, Utah.—Special.—The contract for constructing sidewalk extension No. 208 was awarded to Davis & Heuser, of this city, for $6,623.81.

Delphi, Ind.—John M. McGreevy has been awarded contracts for constructing gravel roads as follows: Reef gravel road, $5,107; Kingery gravel road, $7,106.

Jacksonville, Fla.—The contract for delivering 5,000 cu. yds. of oyster shell paving material was awarded, Dec. 1., to H. P. Hutte at $1.03 a cu. yd.

Guthrie, Okla.—The contract for 102,851 sq. yds. of asphalt paving and 98,294 sq. yds. of brick paving was awarded, Dec. 13, to the Chicago Asphalt & Rubber Co.

Mount Vernon, Ind.—Contracts for constructing gravel roads were awarded to H. C. Eigemann, of Rockport, for $11,000, and Clark C. White, of Boonville, for $25,800.

Franklin, Ind.—The contract for constructing 12,224 ft. of gravel roadway was awarded to John W. Rivers and James W. Brown, of Bargersville, for $2,522.

Muncie, Ind.—The contract for constructing 2 public highways was awarded to George Saunders, of this city, for $1,300. Luther Manor, of Redkey, Ind., was awarded a contract for building 2 roads for $8,212.

Newton, N. J.—Geo. F. Snyder & Son, of Philadelphia, Pa., secured the contract for constructing a macadam road 10 miles in length, from Stanhope to this town, for $62,722.

Denver, Colo.—The contract for grading, curbing and improving the streets in Capitol Hill Impv. Dist. Nos. 5 and 6 was awarded to the Denver & Pueblo Constr. Co., for $88,043 and $117,950 respectively.

Frankfort, Ind.—The contract for constructing 2 gravel roads was awarded to V. A. Clark, of Phillisburg, Ind., for $10,-010; 2 roads, Frankfort Construction Co., $9,300; 1 road, Giles D. Knapp, city, $3,-261; 1 road, Kelly Bros., city, $1,986.

Indianapolis, Ind.—The contract for paving Vermont st. from Noble st. to Pogue's Run, with asphalt, with brick gutters and curb, was awarded to the Union Asphalt Construction Co. at $4.73 a ft.; water connections, 75 cts.; sewer, $1; gas connections, $6.

Hartford, Conn.—Contracts for constructing State road work have been awarded as follows: 3,650 ft. in Waterford, Henry H. Morgan, of New London, $1.24 a lin. ft.; 9,850 ft. of macadam-telford road in New London and Lyme turnpike, T. H. Gill & Co., of Winter Hill Station, Boston, Mass., $1.67 a lin. ft.

Noblesville, Ind.—Contracts for constructing gravel roads have been awarded as follows: H. L. Findley Co., Noblesville, 7 contracts, $38,924; D. C. Wiggins, Jr., Tipton, Ind., $14,746.90; Clyde Clark, Westfield, Ind., $3,668; Nees & Co., Frankfort, Ind., $5,595; Wheeler & Parr, Sheridan, Ind., $3,700; J. H. Clark, Westfield, Ind., $1,673.50; Eli T. Pickard, Kempton, Ind., 6,765 ft., $3,095.

Belle Fourche, S. D.—Hayes Bros., who have the contract for constructing the big storage reservoir of the Belle Fourche irrigation project, have sublet portions of the work as follows: Paving the face of the dam with concrete blocks, A. F. Burke & Co., of St. Louis; placing on screened and unscreened gravel, Hicks Bros., of St. Louis; concrete work, Peoples Construction Co., of Davenport, Ia.

Spokane, Wash.—Contracts for grading, curbing and parking have been awarded as follows: Cataldo ave., H. L. Lilienthal, $10,340; sidewalks, Copson & Carson, sidewalks, J. C. Kennedy, $196; Lancaster st., Abbott & Joslin, $1,918; sidewalks, $1,098; 14th ave., Foster & Hindle, $925; Copson & Carson, $993; Sherbrooke st., Mitchell Bros., $1,734; sidewalks, Copson & Carson, $1,093.

Kansas City, Mo.—Contracts for asphalt paving were awarded, Dec. 4, as follows: Garfield and Kansas sts., Parker-Washington Co., $1.92 a sq. yd.; 8th and Wyoming sts., Cleveland Trinidad Paving Co., $2.18; Scarritt st., Barber Asphalt Paving Co., $1.96. Contracts were awarded, Dec. 10, as follows: Grauman ave., Barber Asphalt Paving Co., $1.95 a sq. yd.; 9th st., Cleveland Trinidad Co., $2.10.

Indianapolis, Ind.—Contracts have been awarded as follows: Asphalt paving in Alabama st., from South to Merrill, Marion County Construction Co., $7.43 for roadway, gutters, ceemnt walks and curbs; approach walks, 30 cts.; sodded lawns, 15 cts.; water connections, 75 cts.; sewer connections, 75 cts.; gas connections, $6. Parker ave., asphalt with brick gutters, Marion County Construction Co., $3.30; Park ave., cement walks and curbing, John Arnold, $1.16; Hawthorne Lane, cement walks, F. W. Abel, 61 cts.; Thirtieth st., cement walks and curbing, Lackey Bros., $1.20; Thirty-first st., cement walks and curbing, John Arnold, $1.21.

SEWERS.

Trenton, N. J.—The State board of health has sent out notices to the city of Camden, the borough of Riverton and the city of Salem, that they must install sewage disposal plants and stop the pollution of the Delaware river.

CONTEMPLATED WORK.

Lindsborg, Kan.—Plans are being prepared for a sewerage system.

Angola, Ind.—Plans are being prepared for constructing a sewerage system.

Davenport, Ia.—A large storm water drain for East Davenport is proposed.

Miller, Ind.—Plans for a sewerage system have been prepared. N. T. Z. Elibor, clk.

Holdenville, Okla.—Bids will be received about March 1 for constructing a sewerage system.

Tallapoosa, Ga.—This city is considering the construction of a sanitary sewer system.

Lancaster, O.—The State board of health has approved plans for a new sewerage system.

Cedar Rapids, Ia.—Council will take action Jan. 4 on the construction of certain sewers.

Marshfield, Ore.—About $55,000 will be expended on the construction of sewers during 1909.

Bushnell, Ill.—Plans are being prepared for constructing a sewerage system. W. H. Dawson, clk.

Shelby, N. C.—Special.—J. D. Suttle, mayor, desires to purchase machinery and tools for sewers.

Batavia, N. Y.—This city will vote again on the question of constructing a sewerage system.

Monson, Mass.—Surveys are being made for constructing a sewerage system. C. L. Peck, town clk.

Washington, Kan.—Plans for sanitary sewers are being prepared by Burns & McDonnell, of Kansas City.

Faribault, Minn.—Bids will be received next spring for constructing storm sewers. D. F. Mackenzie, clk.

West Branch, Mich.—Special.—C. J. Phelps is in the market for materials for sewerage construction.

Seymour, Tex.—This city voted to issue bonds for constructing sewerage and water works systems.

Shawnee, Okla.—The construction of 6 and 8-in. vitrified pipe sewers is proposed. A. D. Maryin, cy. clk.

Columbia City, Ind.—Plans are being prepared for constructing sewers in the northwest part of the city.

Richmond Hill (Jamaica, L. I., P. O.), N. Y.—Plans are being prepared for constructing a new sewerage system.

Mount Vernon, O.—Plans for constructing a sewage disposal plant have been approved by the State board of health.

St. Paul, Minn.—The proposed Portland-Aldine sewer system has been favorably reported upon by the board of public works.

South Bend, Ind.—Bids will be called for soon for constructing a sewer in Niles ave. W. A. McIntyre, chmn. B. P. W.

Springfield, O.—Plans have been completed for constructing sewers in Maiden Lane and Cedar st. M. J. Bahin, cy. engr.

Chadron, Neb.—Special.—James W. Finnegan, mayor, advises us that he is interested in a sewerage system for this village.

Vincennes, Ind.—Plans are being prepared for a sewerage system and pumping plant. J. V. Hershey, engr., City Hall.

Ardmore, Okla.—Special.—H. H. Sayre, cy. engr., says this city contemplates the installation of septic tanks for sewage disposal.

McAlester, Okla.—This city will vote Jan. 19 on the issue of $175,000 bonds for

storm and sanitary sewers. J. M. Gannaway, cy. clk.

College Hill (Cincinnati P. O.), O.—Plans for a sewerage system and sewage purification plant have been approved by the State board of health.

Lake Pleasant, Mass.—The construction of a sewerage system for the protection of the water supply of the Turner Falls fire district is contemplated.

Sewickley, Pa.—The State commissioner of health has notified this city that plans for a sewage disposal plant must be submitted to him by July 1, 1909.

Mount Morris, Ill.—Special.—Plans for a complete sewerage system, embracing 35,936 ft. of sewers, have been completed by J. A. Davison, engr., of Polo, Ill.

Peoria, Ill.—Plans are being prepared and contracts will be let soon for constructing a sewerage system to reclaim a vast area of land in the lower end of this city.

Kokomo, Ind.—Plans are being prepared for constructing 40,000 ft. of 8 to 10-in. reinforced concrete sewers to be built in Wildcat creek to city limits. W. F. Mann, cy. engr.

Canton, O.—An ordinance has been passed providing for an issue of $24,800 bonds for constructing a storm sewer in Liberty st. from Saxton st. to Nimishillen creek.

Bordentown, N. J.—Special.—Edwin G. Kastenhuber, Jr., resident engr., P. O. Box 577, says machinery and tools may be purchased for sewerage, sewage disposal and sub-soil drainage.

Scottdale, Pa.—Council has directed J. B. Hogg, of Connellsville, to make a plan for sewers so that this city will be ready if, in the future, a disposal plant is ordered to be put in.

Red Wing, Minn.—Plans for sewer extensions in the West End, to include 1½ miles of tile pipe, have been prepared by A. R. Rhame, cy. engr. Bids will be asked for next spring. Leon Meyers, clk.

Coalinga, Cal.—Special.—Plans for a sanitary sewerage system, requiring 51,000 ft. of vitrified pipe sewer, are being made by M. L. Weaver, cy. engr. of Visalia, who desires catalogs of manhole covers and rings, lamp-hole covers and flush tank apparatus.

Milwaukee, Wis.—In a conference held by Mayor Rose, City Engineer Charles J. Poetsch and Health Commissioner G. A. Bading recently, they decided to employ Harrison P. Eddy, of Boston, George C. Whipple, of New York City, and John W. Alvord, of Chicago, to report on the best method of handling the sewage now emptying into the Menominee river.

Warren, O.—Special.—The board of public service has retained Alexander Potter, of New York City, to design a sanitary and storm sewer system, and a sewage disposal system. This city already has a number of sewers constructed without any regard to a general plan, and it is the intention to utilize as many of the existing sewers as possible. Mr. Potter will be assisted in his work by the city engineer, Bert C. Smith, who will have charge of the field work and surveys for the proposed improvements. After the plans have been completed the people will be called upon to vote on the project.

Washington, Ind.—Plans have been prepared and bids will be received about next April for a sewerage system. G. Faith, cy. engr.

CONTRACTS TO BE LET.

Valparaiso, Ind.—Bids are asked until Jan. 8 for constructing a sewer. Cy. clk. Jones.

Erie, Pa.—Bids are asked until Jan. 7 for constructing a sewer here. B. E. Briggs, cy. engr.

Anoka, Minn.—Bids are asked until Jan. 9 for constructing ditch No. 49. A. A. Caswell, co. audt.

Winchester, Ind.—Bids are asked until Jan. 6 for constructing a lateral sewer. S. D. Fox, cy. clk.

Alton, Ill.—Bids are asked until Jan. 15 for constructing a trunk sewer in the East Side. E. Beall, mayor.

East Cleveland, O.—Bids are asked until Jan. 9 for building 24-in. circular culverts. Kline F. Leet, vil. clk.

Delphi, Ind.—Bids are asked until Jan. 9 for constructing a drain in Jefferson twp. J. D. Zartwell, supt. of constr.

Charleston, W. Va.—Bids are asked until Jan. 6 for constructing 7,340 ft. of 8 to 42-in. sewer. W. A. Hogue, cy. engr.

Herington, Kan.—Bids are asked until Feb. 1 for constructing sewers and a sewage disposal plant. B. C. Crary, cy. clk.

St. Paul, Minn.—Bids are asked until Jan. 2 for constructing State ditch No. 63. S. G. Iverson, secy. State drainage comm.

Polk, Pa.—Bids are asked until Jan. 13 for constructing a sewage disposal plant. J. A. Murdoch, supt. State Inst. for Feeble Minded.

Salt Lake City, Utah.—Bids are asked until Jan. 8 for constructing pipe sewers in sewer extension No. 219. Louis C. Kelsey, cy engr.

Cincinnati, O.—Bids are asked until Jan. 8 for constructing 2 concrete arches and reinforced concrete box culvert. Stanley Struble, pres. co. commrs.

Gary, Ind.—Bids are asked until Jan. 15 for constructing sewers in Broadway and Madison sts., including 940 ft. of vitrified brick sewers and 1,700 ft. of 12 to 18-in. vitrified sewer tile. A. P. Melton, cy. engr.

Danville, Pa.—Bids are asked until Jan. 14 for constructing 7,500 ft. of terra cotta pipe sewer, a sewage disposal plant consisting of concrete sedimentation tanks, sprinkling and sand filters, 12-in. c. i. force main and electrically driven and automatically controlled centrifugal sewage pumps. H. B. Meredith, supt. State Hosp. for Insane.

CONTRACTS AWARDED.

Chester, Pa.—The contract for constructing the Upland st. sewer was awarded to John J. Williams & Co. for $14,775.

Seattle, Wash.—The contract for constructing sewers in W. 60th st. was awarded to the International Contract Co. for $12,333.90.

Louisville, Ky.—The contract for constructing the 29th st. sewer was awarded to Paul & Kerschner, of Dayton, O., for about $15,000.

Fitzgerald, Ga.—Sullivan & Son, of Bessemer, Ala., secured the contract for constructing a sewerage system for about $75,000.

Independence, Kan.—The contract for constructing the West Side sewer was awarded to Rushmore & Gowdy, of Cherryvale, Kan., for $11,342.

Salt Lake City, Utah.—Special.—The contract for constructing sewer extension No. 208 was awarded to George Ross and J. F. Johnston, of Salt Lake City, for $890.85.

Roanoke, Va.—The contract for constructing 2 terra cotta sanitary sewers have been awarded to the Roanoke Concrete Co., of this city, for about $3,500.

Covington, Ga.—The contract for constructing a sewerage and water works system was awarded to the General Construction & Contracting Co., of Atlanta.

San Francisco, Cal.—The contract for constructing the north portion of the East Potero intercepting sewer was awarded to the Hanrahan-Erhardt Co. for $78,847.

Grand Rapids, Mich.—Bids were submitted Dec. 10 for new sewage pumping station machinery as follows: Buffalo Steam Pump Co., 490 Broadway, Buffalo, N. Y., $16,710 and $49,758; General Electric Co., Schenectady, N. Y., $15,182; Fort Wayne Electrical Works, $49,378 and $47,162; Westinghouse Electrical Mfg. Co., 209 Ninth St., Pittsburg, Pa., $15,924 and $61,022; Jeanesville Iron Works, $38,370 and $44,170; D'Olier Engineering Co., 121 South Eleventh St., Philadelphia, Pa., $45,843 and $69,200.

Troy, N. Y.—Bids for constructing sewers in 24th st., North End and in Glen ave. were submitted as follows: Glen ave., Eveline Bros., Waterford, sewers, $1.59 per ft., laterals 40 cts. per ft.; John Warnock & Sons, sewer, $1.90 per ft., manholes $40 each, laterals 33 cts. per ft.; 24th st., sewer, John Warnock & Son, $4 per ft., catch basins $80 each, manholes $54; William E. McDonough, sewer, $3.75 per ft., manholes $85 each, catch basins $125; Eveline Bros., Waterford, sewer, $4.49 per ft. for work complete. E. L. Grimes, cy. engr.

WATER WORKS.

Allentown, Pa.—Council passed a proposition, Dec. 15, to purchase the plant of the South Allentown Water Co. for more than $26,000.

CONTEMPLATED WORK.

Paris, Tex.—A filtration plant is proposed. E. H. McCustion, mayor.

Rosebud, Tex.—Plans have been prepared for a water works system.

Haskell, Tex.—Estimates are being made for a water works system.

Salina, Utah.—Plans are being prepared for a water works system. Town clk.

North Arlington, N. J.—This borough voted to construct a water works system.

Wheeling, W. Va.—The question of a filtration plant is being revived.

Tonkawa, Okla.—Plans for a water works system are being prepared.

Newark, N. J.—The question of water main extension is being considered.

Hamlin, Tex.—Estimates are being prepared for a water works system.

Capitol Hill, Okla.—Estimates are being prepared for a water works system.

Mesa, Ark.—Plans and specifications are being prepared for a water works system.

Dodge, Neb.—The question of constructing a water works system is under consideration.

Winlock, Wash.—Plans are being prepared for a water works system. C. E. Leonard, town clk.

Parsons, W. Va.—Plans are being prepared for a water works system. W. J. Corrick, cy. recdr.

Oakley, Kan.—The question of constructing a water works system is being discussed.

Saginaw, Mich.—A committee from this city has been inspecting filtration plants in other cities.

Kaufman, Tex.—This city has decided to extend the water mains and will install a turbine wheel.

Hillsboro, Tex.—This city will vote soon on the issue of bonds for improving the water works system.

Yankton, S. D.—A petition is being circulated asking for the construction of a water works system.

Euclid, O.—An ordinance has been passed providing for the construction of a water works system.

Takoma Park, Md.—The advisability of installing water meters throughout this town is under discussion.

Hooker, Okla.—The citizens of this town have voted in favor of the issue of bonds for a water works system.

Rockaway, N. J.—The question of constructing 12,000 ft. of additional water mains is under discussion.

Bridgeville, Del.—H. J. Cannon has been appointed chairman of a committee to secure water works for this town.

Bryan, Tex.—J. T. Moloney advises us that he is interested in the construction of water works, sewerage and lights.

Paris, Tex.—Special.—J. W. Crook, cy. engr., is interested in securing a filter system for the water works system.

Independence, Ia.—Special.—E. R. Stanard, cy. engr., may purchase machinery and tools for electric and water plants.

La Grande, Ore.—Bids will probably be received in March for constructing water works. J. T. Williamson, chmn. water comm.

Beeville, Tex.—Special.—J. C. Harris, secy. and supt. Beeville Water Co., desires to purchase water mains and fire hydrants.

St. Clair, Mich.—The health board has declared the water supply of this city, obtained from St. Clair river, to be impure.

Santa Ana, Cal.—Special.—John McFadden desires to purchase an air compressor and engine and pump, suction and force, to pump 800 gallons per minute.

Shelby, N. C.—Special.—J. L. Suttle, mayor, desires to purchase machinery and tools for water works, sewerage and electric lights.

Carterville, Mo.—Special.—L. M. Janes, mayor, says this city is preparing for the construction of a water works system and the extension of main and district sewers.

Hugo, Okla.—This city has accepted preliminary plans and specifications prepared for the construction of a water works system, and the contract will be awarded about Jan. 15.

Ardmore, Okla.—Special.—H. H. Sayre, cy. engr., says this city contemplates the installation of a filtration plant for the water works system, and septic tanks for sewage disposal.

Trenton, N. J.—In its report to Governor Fort, the State Potable Water Supply Commission indorses the plan for the construction of a reservoir at Mountainview for the conservation of the water supply in this part of the State.

CONTRACTS TO BE LET.

Jamestown, N. D.—Bids will be received Jan. 4 for constructing a new well.

Duluth, Minn.—Bids are asked until Jan. 7 for c. i. water and gas pipes. Water and light commrs.

Wichita, Kan.—Bids are asked until Jan. 4 for constructing a water works system. R. N. Dorr, cy. clk.

Louisville, Ky.—Bids are asked until Jan. 2 for erecting 63 fire hydrants. John Chambers, engr. B. P. W.

Minerva, O.—Bids are asked until Jan. 4 for constructing a water tank and sewer. L. E. Weber, secy. bd. pub. affairs.

Denison, Ia.—Bids are asked until Feb. 1 for boring an artesian well. M. D. Wright, chmn. water commrs.

Spooner, Minn.—Bids will be asked during February for constructing a water works system. C. H. Dodds, vil. clk.

Palmetto, Fla.—Bids are asked until Jan. 5 for a tower, tank, riser pipe, foundation, etc. E. F. Wilson, mayor.

Leesburg, Fla.—Bids are asked until

Jan. 5 for constructing a water works and electric light plant. L. M. Johnson, cy. clk.

East Point, Ga.—Bids are asked until Jan. 19 for constructing a water works and electric light plant. S. M. McConnell, clk. coun.

Los Angeles, Cal.—Bids are asked until Jan. 4 for furnishing pumps and engine for the water works. John J. Fay, Jr., pres. water commrs.

Salt Lake City, Utah.—Bids are asked until Jan. 8 for constructing a pipe line in the 19th ward irrigation ditch. Louis C. Kelsey, cy. engr.

East Grand Forks, Minn.—Bids are asked until Jan. 5 for installing a pumping plant in the municipal water works. C. P. Zimmerman, cy. clk.

Winnipeg, Man.—Bids are asked until Feb. 22 for furnishing and erecting a turbine pump with electric motor for the water works. H. N. Ruttan, cy. engr.

Minneapolis, Minn.—Bids are asked until Jan. 8 for furnishing c. i. water pipe, hydrants, valves and special castings during 1909. L. A. Lydiard, cy. clk.

New York City.—Bids are asked until Jan. 7 for building north half Walkill pressure tunnel under Walkill river and valley, including 3 shafts, concrete conduits, etc. J. Waldo Smith, ch. engr. bd. water sup.

Connersville, Ind.—Sealed bids are asked until Jan. 12 for constructing additions and improvements to the city water works system, requiring a source of pure water supply, a new pumping station, machinery, coal bins, side tracks, pipe lines, etc. Karl L. Hanson, engr.

Holly, Colo.—Bids are asked until Jan. 6 for furnishing machinery for the water works system, including generator and switchboard; deep well pump and motor; underwriter pump and boiler feed pumps; engine, steam boilers, etc. N. F. Vidal, town clk.

CONTRACTS AWARDED.

Canajoharie, N. Y.—The contract for constructing a municipal conduit in Church st. was awarded to F. W. Schuyler for $2,721.92.

Booneville, Ark.—A 50-year franchise for water works was granted, Dec. 11, to W. E. Harrell, J. P. Thayer and Joe Eilercamp.

Covington, Ga.—The contract for constructing a water works system was awarded to the General Contract & Construction Co., of Atlanta.

Spirit Lake, Ia.—The contract for constructing a water works system has been awarded to the Des Moines Bridge & Iron Co. for $19,791.40.

Scranton, Pa.—The contract for a filter was awarded to the New York Continental Jewell Filtration Co., 15 Broad st., N. Y. City, for about $60,000.

Kearny, N. J.—A 25-year contract has been made with the New York and New Jersey Water Co. and the New Jersey Water Co. to furnish water to this town at $75 a million gallons.

Springfield, Mass.—The contract for constructing the Borden Brook dam and reservoir, contract No. 5, Little river water supply, was awarded to Coleman Bros., 15 Court Sq., Boston, Mass., for $169,875.

Portland, Ore.—The contract for furnishing 3,000 meters was awarded as follows: 2,800 meters, Henry R. Worthington Co., 118 Liberty st., N. Y. City; 200 meters, Union Meter Co.; total cost, about $20,000.

Greenville, Tex.—Contracts were awarded Dec. 1 for furnishing c. i. pipe, specials and valves as follows: For c. i. pipe, to American Cast Iron Pipe & Foundry Co., for 6, 8 and 16-in. pipe; valves, 6 and 8-in., to J. B. Newhall & Co.; valves, 14 and 16-in., to F. W. Heilman & Co.; hydrants and valve boxes, to Darling Pump & Mfg. Co., Williamsport, Pa.

Grand Rapids, Mich.—Bids were submitted Dec. 3 for furnishing 800 ⅝-in. water meters, 25 ¾-in., 12 1-in., 5 1½-in., and 5 2-in. water meters, at prices ranging from $6 to $12 each on the ⅝-in. meters. The bids were submitted by the Henry R. Worthington Co., Standard Water Meter Co., National Water Meter Co., Buffalo Meter Co., Simplex Valve & Meter Co., Neptune Meter Co., Badger Meter Co., Thompson Meter Co., Pittsburg Meter Co., Union Water Meter Co., American Valve & Meter Co., and the Hersey Mfg. Co.

Yuba City, Cal.—Contracts for furnishing material and installing a new water works system were awarded, Dec. 11, as follows: Minneapolis Steel and Machinery Co., 91-ft. steel tower with a 28-ft. steel tank of 100,000 gal. capacity; contract price, $5,250; cement foundation for tower, $9 per cu. yd.; bond, $2,000. United States Pipe Co., c. i. pipe, 5,265 ft. 8-in. and 4,542 ft. 6-in., $32.28 per ton; 9,070 ft. 4-in., $33.28; 90 4, 6 and 8-in. specials, 3¼ cts. per lb.; delivery within 75 days; bond, $3,000. Pacific Coast Supply Co., J. S. Bragg, mgr., wrought iron pipe, per 100 ft.: 2,145 ft. 3-in., $24.01; 500 ft. 2½-in., $18.35; 4,830 ft. 2-in., $11.49; 1,000 ft. 1-in., $5.28; 1,000 ft. ¾-in., $3.67; double gate valves, 5 8-in., $16.95 each; 5 6-in., $11.25; 4 4-in., $6.95; 26 6-in. hydrants, $27.50 each; 10 2½-in. Globe valves, $4.80 each; 50 1-in. corporation cocks, $1.05 each; 50 ¾-in. service cocks, 78 cts. each; delivery, 75 days; bond, $1,000.

BRIDGES.

Milwaukee, Wis.—A new viaduct connecting the east and west sides is proposed.

Aberdeen, S. D.—Bids will be asked next spring for constructing 6 steel bridges.

Grenada, Miss.—Bids are asked until Jan. 5 for constructing an iron bridge. Cy. clk.

Stockton, Cal.—Bids are asked until Jan. 5 for constructing 2 steel bridges. Co. supvrs.

Minneapolis, Minn.—Bids are asked until Jan. 11 for repairing a bridge. Hugh R. Scott, co. audt.

Granite Falls, Minn.—Bids are asked until Jan. 6 for building a steel bridge. S. O. Tjosvold.

Albany, Mo.—Bids are asked until Jan. 5 for constructing 6 bridges. W. A. Henton, co. supvr.

Fargo, N. D.—Bids are asked until Jan. 5 for constructing pile bridges. Arthur G. Lewis, co. audt.

Wheeling, W. Va.—Plans and specifications are being prepared for constructing a bridge at Market st.

Paris, Ark.—Bids are asked until March 4 for constructing a number of bridges. J. W. Castleberry, co. judge.

York, Neb.—Bids are asked until Jan. 13 for constructing steel and wooden bridges during 1909. W. A. Miller, co. clk.

Augusta, Ga.—Bids are asked until Jan. 2 for constructing a steel bridge at Center st. Nisbet Wingfield, cy. engr.

Newark, O.—Bids are asked until Jan. 11 for constructing superstructures of 2 bridges. J. N. Wright, co. audt.

Dayton, O.—Bids are asked until Jan. 16 for constructing a steel, reinforced or creodone block bridge. T. J. Kaufman, co. audt.

Cedar Rapids, Ia.—The city council has decided to construct a steel bridge over Indian creek at 13th st. T. R. Warriner, cy. engr.

Rensselaer, Ind.—Bids are asked until Jan. 12 for constructing an iron bridge across the Kankakee river. J. H. Leatherman, co. audt.

St. Louis, Mo.—Plans have been approved for the proposed municipal bridge, which is to be 2,000 ft. long. A. J. O'Reilly, pres. B. P. I.

Sulphur, Okla.—Bids are asked until Jan. 9 for constructing a steel bridge over Rock creek in the park. A. R. Greene, supt. Platt National Park.

Cambridge, Mass.—Plans have been prepared for constructing a reinforced concrete bridge at Royiston st. The Cambridge Art Society is interested.

Dallas, Tex.—Plans are being made for the proposed viaduct over the Trinity and the river bottoms between Dallas and Oak Cliff. J. M. Preston, cy. engr.

Rochester, N. Y.—Bids are asked until Jan. 5 for constructing a lift bridge over the Erie Canal at Allen st. F. C. Stevens, supt. pub. wks., Albana, N. Y.

Norfolk, Va.—The city council is considering an appropriation of $9,000 for the construction of a bulkhead and bridge over Mahone's Lake canal. W. T. Brooks, cy. engr.

Salt Lake City, Utah.—Bids are asked until Jan. 8 for constructing a steel or concrete highway bridge across the Jordan river at N. Temple st. L. C. Kelsey, cy. engr.

Hawaii, H. I.—Bids are asked until Feb. 13 for constructing a concrete and granite dry dock about 1,140 ft. long, 130 ft. wide and 35 ft. deep at the Naval Station, Pearl Harbor.

Cincinnati, O.—Bids are asked until Jan. 8 for constructing the west abutment of bridge on Shier road, and for a concrete bridge over Raceway on Lock st. in Lockland. Stanley Struble, pres. co. commrs.

Lynchburg, Va.—The common council has adopted a resolution directing the engineering department to prepare plans for the construction of a viaduct over the Southern Railway tracks at 5th ave. H. L. Shaner, cy. engr.

STREET LIGHTING.

Glendale, Cal.—Plans are being considered for establishing a street lighting system.

Hawkinsville, Ga.—Voted to issue bonds for installing an electric light plant. C. W. Harris, cy. clk.

Carlyle, Ill.—Plans are being considered for improving the municipal light plant. Geo. Schilling, supt.

Americus, Ga.—The question of constructing a municipal electric light plant is being considered.

Portsmouth, Va.—The construction of an electric light plant is contemplated. Bascom Sykes, cy. engr.

Minco, Okla.—Plans and specifications are being prepared for constructing a municipal light and water plant.

Shelby, N. C.—Special.—J. L. Suttle, mayor, desires to purchase machinery and tools for electric lights, etc.

Leesburg, Fla.—Bids are asked until Jan. 5 for constructing an electric light and water works system. L. M. Johnson, clk.

Bellefonte, Pa.—The question of constructing an electric light plant is under consideration. G. F. Masser, chmn. com.

The Dalles, Ore.—Special.—E. M. Wingate is interested in the proposed purchase of machinery and tools for electric lighting, etc.

Independence, Ia.—Special.—E. R. Stanard, cy. engr., may purchase machinery and tools for electric light and water works plants.

Hartford, Conn.—Bids are asked until Jan. 4 for the public lighting of this city for 1 and 5 yrs. Jas. P. Berry, secy. bd. contr. and sup.

Chicago, Ill.—The People's Gas Light & Coke Co. contemplates the construction of a large gas holder at 95th st. and Houston ave., S. Chicago.

Central City, Neb.—Improvements to the plant of the Central City Gas Co., involving an expenditure of between $4,000 and $5,000, are contemplated.

Fremont, Neb.—Special.—L. S. Frantz, supt., advises us that he is interested in work for which a gas producer plant and engine may be purchased.

White Springs, Fla.—Bids are asked until about Feb. 10 for constructing the proposed power plant on Suwanee river near White Oaks, Fla. Suwanee River R. R. & Power Co.

Albany, Mo.—Bids are asked until Jan. 11 for furnishing this village with a lighting system, either electric or acetylene gas. Thos. Tomasek, vil. recdr.

Portsmouth, O.—Bids are asked until Jan. 7 for lighting the streets, alleys and public places with electricity, gasoline, alcohol or other illuminating medium, for 3, 6 or 10 yrs. Martin W. McMahon, clk. B. P. S.

Highland Park (Richmond P. O.), Va.—Bids are asked until Jan. 5 for granting a 10-yr. franchise for constructing electric light and power systems. W. P. Redd, mayor, 1114 E. Main st., Richmond.

PARKS.

Anderson, Ind.—The city council may purchase the Fair Grounds for a park.

Tulsa, Okla.—Mayor Rohde is urging the issue of additional bonds for a system of public parks.

Knoxville, Tenn.—Mayor John M. Brooks has secured an option on 297 acres of land for the proposed city park.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Portsmouth, Va.—The question of constructing a garbage crematory next year is under consideration. Bascom Sykes, cy. engr.

Boston, Mass.—Bids are asked until Jan. 5 for the erection of a plant for the disposal of combustible waste. Guy C. Emerson, supt. of sts.

Philadelphia, Pa.—The contract for cleaning streets and removing ashes next year was awarded to Edwin H. Vare, of this city, for $1,199,000, and the contract for removing garbage to the Penn Reduction Co., of this city, for $488,988.

FIRE APPARATUS.

Morris, Minn.—Bids are asked until Jan. 12 for furnishing 500 ft. of hose. C. B. Burpee, cy. clk.

Virginia, Minn.—Bids are asked until Jan. 4 for a first size steam fire engine. A. E. Bickford, cy. clk.

Tacoma, Wash.—Bids are asked until Jan. 4 for 75 positive non-interfering 4-round successive fire alarm boxes with Cole key guards. Commr. pub. wks.